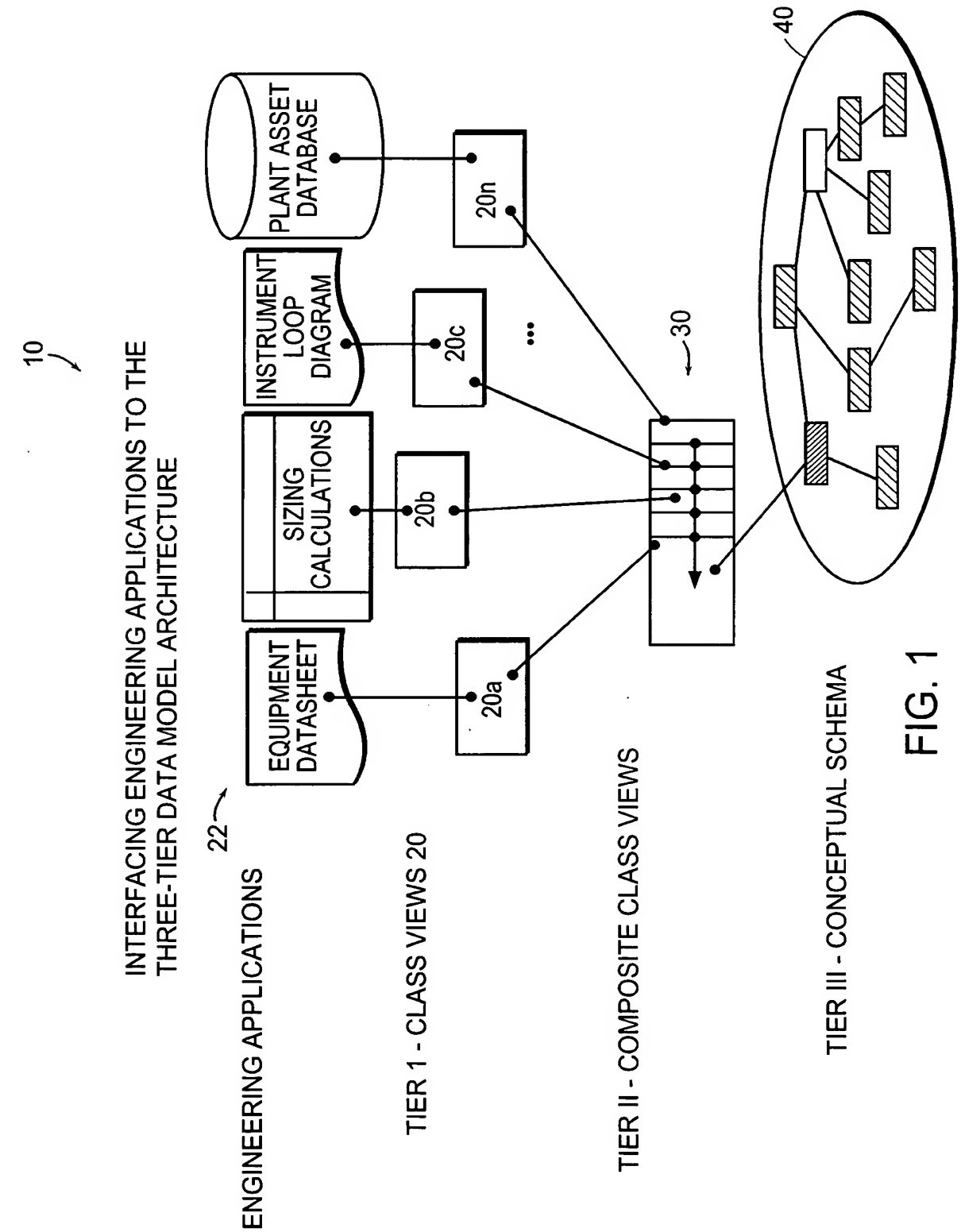

FIG. 1

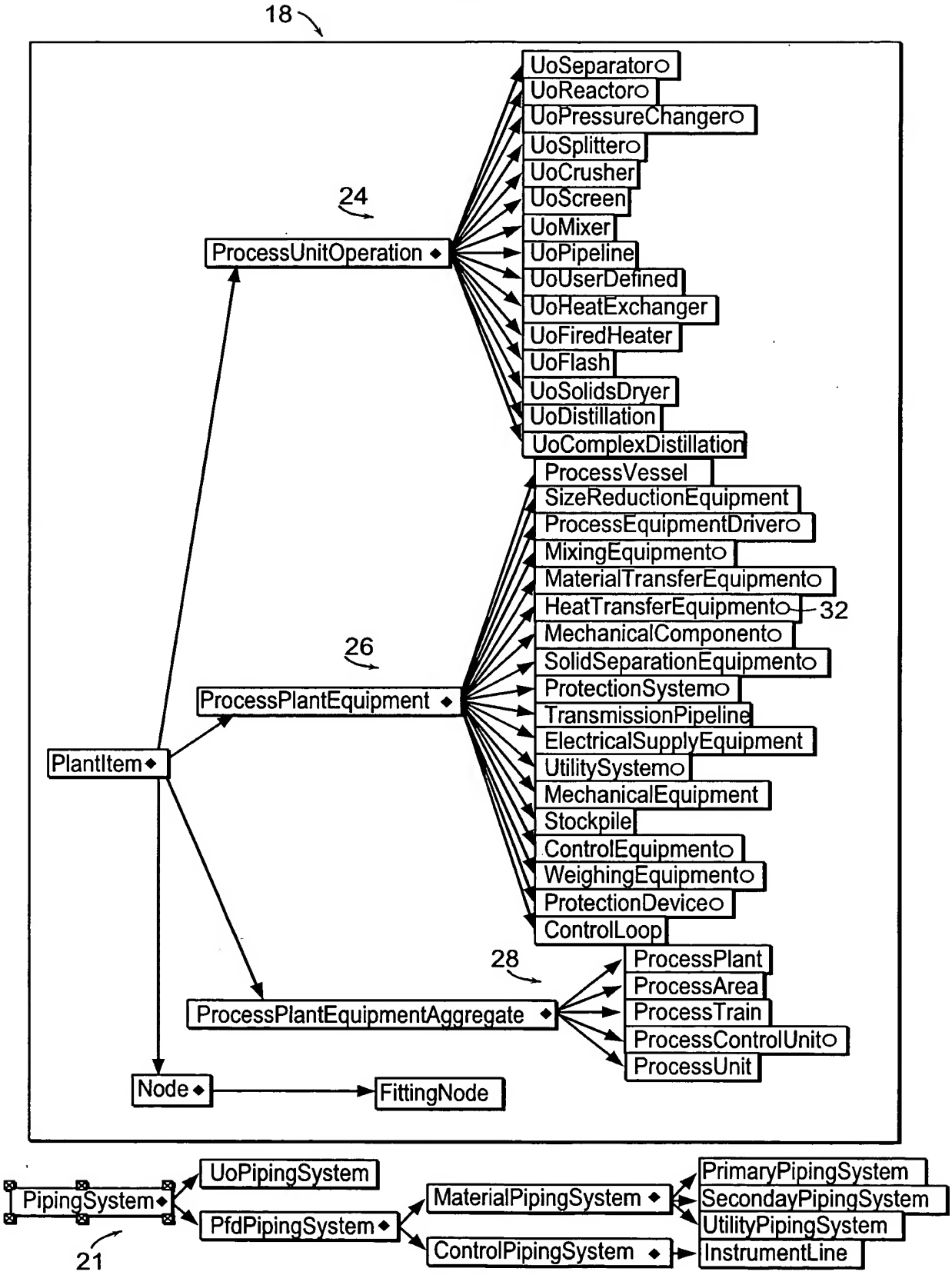
18
24
ProcessUnitOperation
UoSeparator
UoReactor
UoPressureChanger
UoSplitter
UoCrusher
UoScreen
UoMixer
UoPipeline
UoUserDefined
UoHeatExchanger
UoFiredHeater
UoFlash
UoSolidsDryer
UoDistillation
UoComplexDistillation
26
ProcessPlantEquipment
ProcessVessel
SizeReductionEquipment
ProcessEquipmentDriver
MixingEquipment
MaterialTransferEquipment
HeatTransferEquipment
32
MechanicalComponent
SolidSeparationEquipment
ProtectionSystem
TransmissionPipeline
ElectricalSupplyEquipment
UtilitySystem
MechanicalEquipment
Stockpile
ControlEquipment
WeighingEquipment
ProtectionDevice
ControlLoop
PlantItem
28
ProcessPlantEquipmentAggregate
ProcessPlant
ProcessArea
ProcessTrain
ProcessControlUnit
ProcessUnit
Node
FittingNode
PipingSystem
21
UoPipingSystem
PfdPipingSystem
MaterialPipingSystem
ControlPipingSystem
PrimaryPipingSystem
SecondayPipingSystem
UtilityPipingSystem
InstrumentLine

FIG. 2


FIG. 3A
FIG. 3B
FIG. 3C
FIG. 3D
FIG. 3E
FIG. 3F
FIG. 3G
FIG. 3H
FIG. 3I
FIG. 3J

FIG. 3

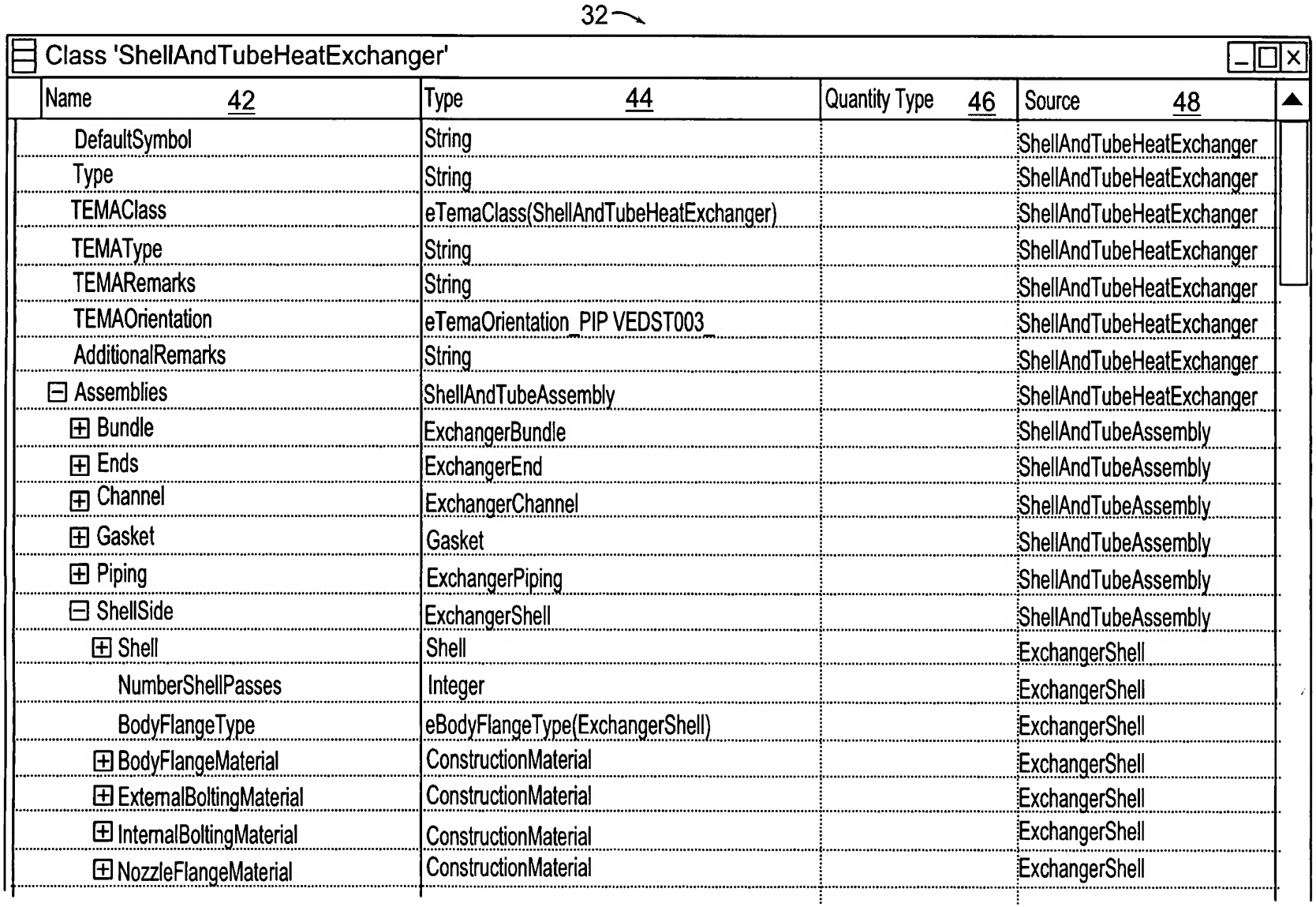
32
Class 'ShellAndTubeHeatExchanger'
Name 42
Type 44
Quantity Type 46
Source 48
DefaultSymbol
String
ShellAndTubeHeatExchanger
Type
String
ShellAndTubeHeatExchanger
TEMAClass
eTemaClass(ShellAndTubeHeatExchanger)
ShellAndTubeHeatExchanger
TEMAType
String
ShellAndTubeHeatExchanger
TEMARemarks
String
ShellAndTubeHeatExchanger
TEMAOrientation
eTemaOrientation_PIP VEDST003_
ShellAndTubeHeatExchanger
AdditionalRemarks
String
ShellAndTubeHeatExchanger
Assemblies
ShellAndTubeAssembly
ShellAndTubeHeatExchanger
Bundle
ExchangerBundle
ShellAndTubeAssembly
Ends
ExchangerEnd
ShellAndTubeAssembly
Channel
ExchangerChannel
ShellAndTubeAssembly
Gasket
Gasket
ShellAndTubeAssembly
Piping
ExchangerPiping
ShellAndTubeAssembly
ShellSide
ExchangerShell
ShellAndTubeAssembly
Shell
Shell
ExchangerShell
NumberShellPasses
Integer
ExchangerShell
BodyFlangeType
eBodyFlangeType(ExchangerShell)
ExchangerShell
BodyFlangeMaterial
ConstructionMaterial
ExchangerShell
ExternalBoltingMaterial
ConstructionMaterial
ExchangerShell
InternalBoltingMaterial
ConstructionMaterial
ExchangerShell
NozzleFlangeMaterial
ConstructionMaterial
ExchangerShell

FIG. 3A

32

⊞ NozzleNeckMaterial	ConstructionMaterial		ExchangerShell
⊞ NozzleReinforcementMaterial	ConstructionMaterial		ExchangerShell
⊞ PipeAndStubEndMaterial	ConstructionMaterial		ExchangerShell
CoverType	eShellCoverType(ExchangerShell)		ExchangerShell
⊞ CoverMaterial	ConstructionMaterial		ExchangerShell
TemaShellType	eShellTEMAType		ExchangerShell
InnerDiameter	Real	Length normal	ExchangerShell
OrientationAngle	Real	Plane angle POT	ExchangerShell
OuterDiameter	Real	Length normal	ExchangerShell
RearSupportPlateType	String		ExchangerShell
Thickness	Real	Length small	ExchangerShell
VerticalHeight	Real	Length normal	ExchangerShell
EffectiveArea	Real	Area normal	ExchangerShell
TotalArea	Real	Area normal	ExchangerShell
AverageMetalTemperature	Real	Temperature tmp	ExchangerShell
⊞ Velocities	ExhangerFluidVelocity		ExchangerShell
ExpansionJointRequired	Boolean		ExchangerShell
⊞ ExpansionJoints	ExpansionJoint		ExchangerShell
⊞ FrontEndVapourBelt	VapourBelt		ExchangerShell
⊞ RearEndVapourBelt	VapourBelt		ExchangerShell
KettleInnerDiameter	Real	Length normal	ExchangerShell
KettleInnerDiameter	Real	Length normal	ExchangerShell
KettlePortAngle	Real	Plane angle POT	ExchangerShell

FIG. 3B

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KettlePortLength	Real	Length normal	ExchangerShell
KettleType	eKettleType(ExchangerShell)		ExchangerShell
⊞ ChannelMaterial	ConstructionMaterial		ExchangerShell
⊞ ChannelCoverMaterial	ConstructionMaterial		ExchangerShell
⊞ FloatingHeadCoverMaterial	ConstructionMaterial		ExchangerShell
⊞ Lining	ConstructionMaterial		ExchangerShell
⊞ Gasket	Gasket		ExchangerShell
InletAtChannelEnd	Boolean		ExchangerShell
NumberCondensateNozzles	Integer		ExchangerShell
NumberInletNozzles	Integer		ExchangerShell
NumberIntermediateNozzles	Integer		ExchangerShell
NumberLiquidOnlyOutletNozzles	Integer		ExchangerShell
NumberOutletNozzles	Integer		ExchangerShell
NumberVapourOnlyOutletNozzles	Integer		ExchangerShell
InletNozzleLocation	eInletNozzleLocation(ExchangerShell)		ExchangerShell
MechanicalCleaning	String		ExchangerShell
EntranceConstruction	eEntranceConstruction(ExchangerShell)		ExchangerShell
ExitConstruction	eExitConstruction(ExchangerShell)		ExchangerShell
⊞ MassBalanceIn	UoPort		ExchangerShell
⊞ MassBalanceOut	UoPort		ExchangerShell
MaximumHydrogenPartialPressure	Real	Pressure abs	ExchangerSide
MaximumH2sPartialPressure	Real	Pressure abs	ExchangerSide
NumberOfPasses	Integer		ExchangerSide

FIG. 3C

32

Remarks	String		MechanicalComponent
NamePrecedent	String		MechanicalComponent
ApplicableTo	eApplicableTo(ProcessPlantEquipment)		ProcessPlantEquipment
DefaultSymbol	String		ProcessPlantEquipment
ConstructionStatus	eConstructionStatus		ProcessPlantEquipment
NamePrecedent	String		ProcessPlantEquipment
⊞ MaterialPorts	MaterialPort		ProcessPlantEquipment
⊞ SignalPorts	SignalPort		ProcessPlantEquipment
EquipmentFunction	String		ProcessPlantEquipment
Manufacturer	String		ProcessPlantEquipment
PurchasedCapitalCost	Real	Currency	ProcessPlantEquipment
DeliveredCapitalCost	Real	Currency	ProcessPlantEquipment
InstalledCapitalCost	Real	Currency	ProcessPlantEquipment
NumberOfSpares	Integer		ProcessPlantEquipment
NumberInService	Integer		ProcessPlantEquipment
NumberRequired	Integer		ProcessPlantEquipment
PidNumber	String		ProcessPlantEquipment
Size	String		ProcessPlantEquipment
Function	String		ProcessPlantEquipment
OperatingFactor	String		ProcessPlantEquipment
Model	String		ProcessPlantEquipment
SerialNumber	String		ProcessPlantEquipment
ManufacturersSerialNumber	String		ProcessPlantEquipment

FIG. 3D

FabricationSerialNumber	String	ProcessPlantEquipment
OperationMode	eOperationMode(MechanicalEquipment)	ProcessPlantEquipment
⊞ MaterialSchedule	ConstructionMaterial	ProcessPlantEquipment
⊞ ShippingRequirements	ShippingRequirements	ProcessPlantEquipment
⊞ Location	Location	ProcessPlantEquipment
⊞ NoiseSpecification	NoiseSpecification	ProcessPlantEquipment
⊞ SpaceRequired	SpaceRequirement	ProcessPlantEquipment
⊞ InspectionAndTests	InspectionAndTests	ProcessPlantEquipment
⊞ DesignCodes	DesignCode	ProcessPlantEquipment
⊞ SpareParts	SpareParts	ProcessPlantEquipment
⊞ Weights	Weights	ProcessPlantEquipment
⊞ Represents	ProcessUnitOperation	ProcessPlantEquipment
⊞ NormalOperatingCriteria	OperatingCriteria	ProcessPlantEquipment
⊞ MaximumOperatingCriteria	OperatingCriteria	ProcessPlantEquipment
⊞ MinimumOperatingCriteria	OperatingCriteria	ProcessPlantEquipment
⊞ NormalContents	MaterialAmountSpecification	ProcessPlantEquipment
⊞ NormalContents	MaterialAmountSpecification	ProcessPlantEquipment
⊞ MinimumContents	MaterialAmountSpecification	ProcessPlantEquipment
⊞ MaximumContents	MaterialAmountSpecification	ProcessPlantEquipment
ManufacturerAddress1	String	ProcessPlantEquipment
ManufacturerAddress2	String	ProcessPlantEquipment
ManufacturerPhone	String	ProcessPlantEquipment
Fabricator	String	ProcessPlantEquipment
FabricatorAddress1	String	ProcessPlantEquipment

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FIG. 3E

32

FabricatorAddress2	String		ProcessPlantEquipment
FabricatorPhone	String		ProcessPlantEquipment
SuppliedBy	ePurchaserOrManufacturer		ProcessPlantEquipment
MountedBy	ePurchaserOrManufacturer		ProcessPlantEquipment
ModelNumber	String		ProcessPlantEquipment
ApplicableStandard	String		ProcessPlantEquipment
Orientation	String		ProcessPlantEquipment
⊞ Customer	ProcessPlantCorporation		ProcessPlantEquipment
JobNumber	String		ProcessPlantEquipment
PoNumber	String		ProcessPlantEquipment
PoDate	String		ProcessPlantEquipment
InquiryBy	String		ProcessPlantEquipment
InquiryNumber	String		ProcessPlantEquipment
SpecificationNumber	String		ProcessPlantEquipment
RequisitionNumber	String		ProcessPlantEquipment
SAPNumber	String		ProcessPlantEquipment
⊞ MaximumUtilities	SiteUtilityService		ProcessPlantEquipment
⊞ MinimumUtilities	SiteUtilityService		ProcessPlantEquipment
⊞ Utilities	SiteUtilityService		ProcessPlantEquipment
⊞ UtilitySummary	UtilitySummary		ProcessPlantEquipment

FIG. 3F

PaintSpecifications	PaintSpecifications 32	ProcessPlantEquipment
Mounting	Boolean	ProcessPlantEquipment
CostingReference	String	ProcessPlantEquipment
CostData	Cost	ProcessPlantEquipment
ControlEquipment	ControlEquipment	ProcessPlantEquipment
Documentation	Documentation	ProcessPlantEquipment
SupplierData	ProcessPlantCorporation	ProcessPlantEquipment
CustomerData	ProcessPlantCorporation	ProcessPlantEquipment
FabricatorData	ProcessPlantCorporation	ProcessPlantEquipment
ManufacturerData	ProcessPlantCorporation	ProcessPlantEquipment
Purchaser	ProcessPlantCorporation	ProcessPlantEquipment
Type	String	PlantItem
ItemNumber	String	PlantItem
ItemSequenceNumber	String	PlantItem
ItemSuffix	String	PlantItem
CompleteItemNumber	String	PlantItem
Comments	Comment	PlantItem
Notes	String	PlantItem
Description	String	PlantItem
NormalDesignCriteria	DesignCriteria	PlantItem
MinimumDesignCriteria	DesignCriteria	PlantItem
MaximumDesignCriteria	DesignCriteria	PlantItem
CaseName	String	PlantItem
MaterialConstruction	ConstructionMaterial	PlantItem

FIG. 3G

32

	ConstructionMaterial		PlantItem
⊞ Insulation	ConstructionMaterial		PlantItem
⊞ Insulation	ConstructionMaterial		PlantItem
⊟ Nozzles	Nozzle		PlantItem
Entrance Type	eEntrancetype(Nozzle)		Nozzle
NozzleFunction	eNozzleFunction(Nozzle)		Nozzle
NozzleMark	String		Nozzle
Number	Integer		Nozzle
NozzleType	eType(Nozzle)		Nozzle
NozzleOrientation	Real	Plane Angle	Nozzle
FlangeAndGasketByVendor	Boolean		Nozzle
FlangedOrStudded	eFlangedOrStuddedNozzle		Nozzle
DesignApprovalRequired	Boolean		Nozzle
DistanceFromCenter	Real	Length	Nozzle
HeightUnderNozzle	Real	Length	Nozzle
LocationRelativeToUbend	eLocationRelativeToUbend(Nozzle)		Nozzle
Position	ePosition(Nozzle)		Nozzle
Facing	eFacing(Nozzle)		Nozzle
⊞ Lining	ConstructionMaterial		Nozzle
Reinforced	String		Nozzle
Bore	Real	Length	Nozzle
NominalSize	Real	Length	Nozzle
OuterDiameter	Real	Length	Nozzle
Rating	eRating(Nozzles)		Nozzle

FIG. 3H

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PressureRating	Real	Pressure	Nozzle
TemperatureRating	Real	Temperature	Nozzle
FlangeVelocity	Real	Velocity	Nozzle
PressureDrop	Real	PressureDiff	Nozzle
Rhov2	Real	Density Velocity Sq	Nozzle
Velocity	Real	Velocity	Nozzle
AllowableForceAxial	Real	Force	Nozzle
AllowableForceHorizontal	Real	Force	Nozzle
AllowableForceVertical	Real	Force	Nozzle
AllowableMomentAxial	Real	Bending Moment(Torq	Nozzle
AllowableMomenHorizontal	Real	Bending Moment(Torq	Nozzle
AllowableMomenVertical	Real	Bending Moment(Torq	Nozzle
⊞DistributorBelt	DistributorBelt		Nozzle
⊞Flange	Flange		Nozzle
Flanged	eFlanged(Nozzle)		Nozzle
⊞Gasket	Gasket		Nozzle
MatingPartsFurnished	Boolean		Nozzle
⊞NozzleDome	NozzleDome		Nozzle
⊞PipingTerminator	PipingTerminator		Nozzle
VortexBreaker	Boolean		Nozzle
Threaded	Boolean		Nozzle
ThreadedParameterA	Real	Length	Nozzle
ThreadedParameterB	Real	Length	Nozzle
ThreadedParameterC	Real	Length	Nozzle

FIG. 3I

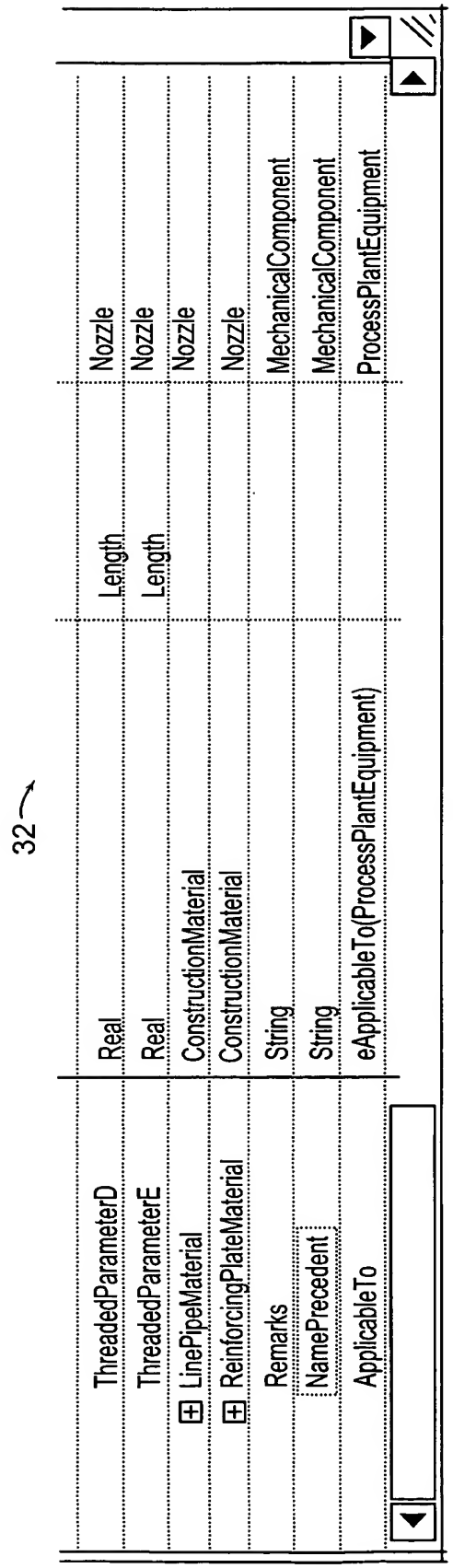
32
ThreadedParameterD
Real
Length
Nozzle
ThreadedParameterE
Real
Length
Nozzle
LinePipeMaterial
ConstructionMaterial
Nozzle
ReinforcingPlateMaterial
ConstructionMaterial
Nozzle
Remarks
String
MechanicalComponent
NamePrecedent
String
MechanicalComponent
ApplicableTo
eApplicableTo(ProcessPlantEquipment)
ProcessPlantEquipment

FIG. 3J

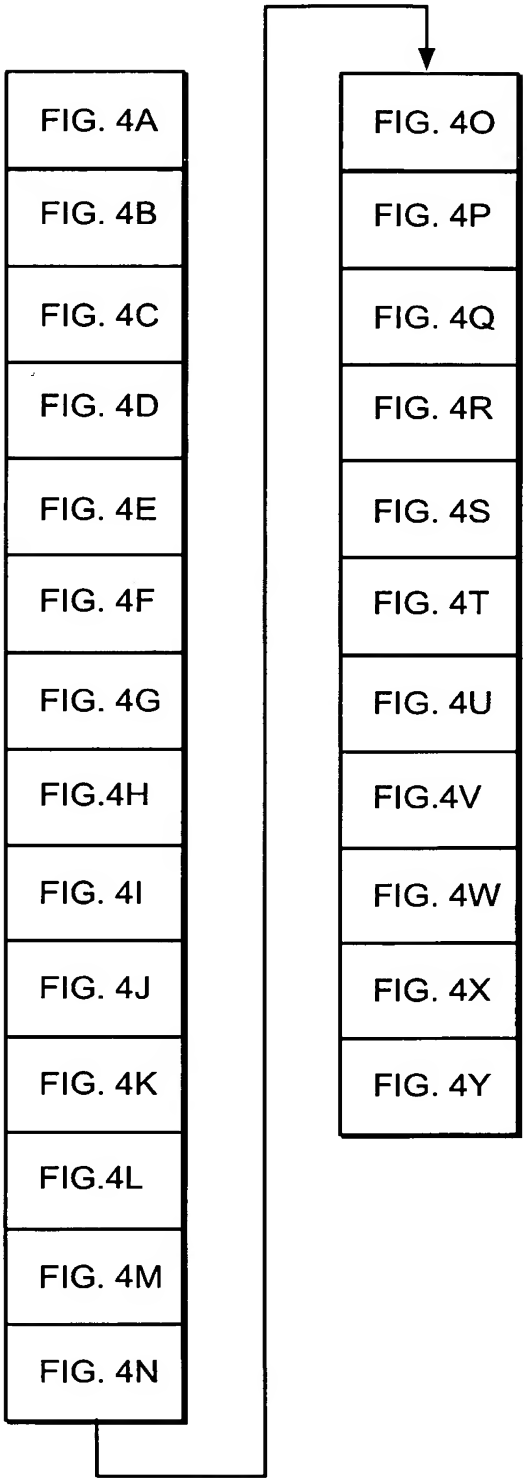
FIG. 4A
FIG. 4B
FIG. 4C
FIG. 4D
FIG. 4E
FIG. 4F
FIG. 4G
FIG.4H
FIG. 4I
FIG. 4J
FIG. 4K
FIG.4L
FIG. 4M
FIG. 4N
FIG. 4O
FIG. 4P
FIG. 4Q
FIG. 4R
FIG. 4S
FIG. 4T
FIG. 4U
FIG.4V
FIG. 4W
FIG. 4X
FIG. 4Y

FIG. 4

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CompositeView 'ShellAndTubeHeatExchanger'

Name	Type	Quantity Type	Route 36
AdditionalRemarks	String		AdditionalRemarks
BaffleCut	Real	Percentage PQI	Assemblies.Bundle,Baffles,BaffleCut
BaffleCutOrientation	String		Assemblies.Bundle,Baffles.Orientation
BaffleCutType	String		
BafflePercentageCutForAreaBasis	Real	Percentage	Assemblies.Bundle,Baffles,PercentAreaCut
BafflePercentageCutForShellInnerDiamete	Real	Percentage	Assemblies.Bundle,Baffles,PercentDiameterFirstCut
BafflePitch	Real	Length normal	Assemblies.Bundle,Baffles,Pitch
BafflePitchMaximum	Real	Length small	
BafflesAndSupportPlates	String		Assemblies.Bundle,Baffles,MaterialOfConstrucion.MaterialName
BaffleShellDiametralClearance	Real	Length normal	Assemblies.Bundle,BaffleToShellClearance
BafflesMaterial	String		Assemblies.Bundle,Baffle,MaterialOfConstruction,MaterialName
BafflesNumber	Integer		Assemblies.Bundle,NumberOfBaffles
BafflesNumberAllowable	String		
BafflesNumberMinimize	Boolean		
BaffleSpacing	Real	Length	Assemblies.Bundle,NominalBaffleSpacing
BaffleSpacingFromInlet	Real	Length	Assemblies.Bundle,Tubesheets(1).DistanceFromFrontTubeSheetFace
BaffleSpacingFromOutlet	Real		
BaffleSpacingMaximum	Real	Length small	
BaffleSpacingMinimum	Real	Length small	
BafflesPresent	String		
BaffleSpacersTieRodsCorrosionAllowance	Real	Length small	Assemblies.Bundle,Tubesheets(1).TieRods.MaterialOfConstruction,CorrosionAllowance

FIG. 4A

34

BaffleSpacersTieRodsMaterial	String		Assemblies.Bundle.Tubesheets(1).TieRods.MaterialOfConstruction,MaterialName
BaffleThickness	Real	Length small	Assemblies.Bundle.Baffles,Thickness
BaffleType	eType(ExchangerBaffle)		Assemblies.Bundle.Baffles,BaffleType
BundleDiameter	Real	Length	
BundleEntranceRv2	Real	Density Velocity Sq	Assemblies.PerformanceCriteria,ShellsidePerformance,BundleEntraceRhov2
BundleExitRv2	Real	Density Velocity Sq	Assemblies.PerformanceCriteria,ShellsidePerformance,BundleExitRhov2
BundleFirstTubeRowToInletDistance	Real	Length small	
BundleLastTubeRowToOutletDistance	Real	Length small	
BundleOuterDiameterMaximum	Real	Length (m)	Assemblies.Bundle,MaximumDesignCriteria(1).BundleOuterDiameter
BundleShellDiameterClearance	Real	Length small	
BundleWeight	Real	Mass	Assemblies.Bundle,Weights,TotalOperating
BundleNormalOrFull	String		
BypassSealRequired	Boolean		Assemblies,Bundle,BypassSeal,BypassSealRequired
BypassSealType	String		Assemblies,Bundle,BypassSeal,SealType
ChannelBodyFlangeMaterial	String		Assemblies,Channel,BodyFlangeMaterial,MaterialName
ChannelBodyFlangesCorrosionAllowance	Real	Length small	Assemblies,Channel,BodyFlangeMaterial,CorrosionAllowance
ChannelCorrosionAllowance	Real	Length small	Assemblies,Channel,ChannelMaterial,CorrosionAllowance
ChannelCoverCorrosionAllowance	Real	Length small	Assemblies,Channel,CoverMaterial,CorrosionAllowance
ChannelCoverMaterial	String		Assemblies,Channel,CoverMaterial,MaterialName
ChannelExitInsulationMaterial	String		Assemblies,Channel,ExitInsulationMaterial,MaterialName
ChannelExitInsulationThickness	Real	Length small	Assemblies,Channel,ExitInsulationMaterial,Thickness
ChannelExternalBoltingCorrosionAllowance	Real	Length small	Assemblies,Channel,ExternalBoltingMaterial,CorrosionAllowance
ChannelExternalBoltingMaterial	String		Assemblies,Channel,ExternalBoltingMaterial,MaterialName
ChannelHeadCorrosionAllowance	Real	Length small	Assemblies,Channel,CoverMaterial,CorrosionAllowance

FIG. 4B

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ChannelHeadMaterial	String		Assemblies.Channel.CoverMaterial.MaterialName
ChannelInletInsulationMaterial	String		Assemblies.Channel.InletInsulationMaterial.MaterialName
ChannelInletInsulationThickness	Real	Length small	Assemblies.Channel.InletInsulationMaterial.Thickness
ChannelInternalBoltingCorrosionAllowance	Real	Length small	Assemblies.Channel.InletInsulationMaterial.CorrosionAllowance
ChannelInternalBoltingMaterial	String		Assemblies.Channel.InrernalBoltingMaterial.MaterialName
ChannelMaterial	String		Assemblies.Channel.ChannelMaterial.MaterialName
ChannelNozzleFlangeMaterial	String		Assemblies.Channel.NozzleFlangeMaterial.MaterialName
ChannelNozzleFlangeCorrosionAllowance	Real	Length small	Assemblies.Channel.NozzleFlangeMaterial.CorrosionAllowance
ChannelNozzleNeckMaterial	String		Assemblies.Channel. NozzleNeckMaterial.MaterialName
ChannelNozzleNecksCorrosionAllowance	Real	Length small	Assemblies.Channel. NozzleNeckMaterial.CorrosionAllowance
ChannelNozzleReinforcementCorrosionAllowance	Real	Length small	Assemblies.Channel. NozzleReinforcementMaterial.CorrosionAllowance
ChannelNozzleReinforcementMaterial	String		Assemblies.Channel. NozzleReinforcementMaterial.MaterialName
ChannelPipeandstubEndsCorrosionAllowance	Real	Length small	Assemblies.Channel.PipeAndStubEndsMaterial.CorrosionAllowance
ChannelPipeandstubEndsMaterial	String		Assemblies.Channel.PipeAndStubEndsMaterial.MaterialName
CodeRequirements	String		AsmeCode
ColdInletStream	MaterialFlowSpecification		MaterialPorts[ThermalAllocation="ColdIn"].Flow
ColdOutletStream	MaterialFlowSpecification		MaterialPorts[ThermalAllocation="ColdOut"].Flow
ColdSideDesignPressure	Real	Pressure abs	ColdSide.NormalDesignCriteria.Pressure
ColdSideDesignTemperature	Real	Temperature tmp	ColdSide.NormalDesignCriteria.Temperature
ColdSideFlangeFacing	String		ColdSide.FlangeFacing
ColdSideFlangeRating	String		ColdSide.FlangeRating
ColdSideFluidAllocation	eHotFluidAllocation\Shel		NormalDesignCriteria(1).ColdFluidAllocation
ColdSideFluidName	String		MaterialPorts[ThermalAllocation="ColdIn"].Flow.Name
ColdSideFoulingResistance	Real	Thermal Resistance	ColdSide.FoulingResistance

FIG. 4C

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ColdSideFoulingThickness	Real	Length small	ColdSide.FoulingThickness
ColdSideFullVacuum	Boolean		ColdSide.NormalDesignCriteria.FullVacuum
ColdSideGasketMaterial	String		
ColdSideHeatBalanceMethod	String		
ColdSideHeatCurves	ExchangerFluidProfile		ColdSide.FluidProfiles(*)
ColdSideInletEnthalpyMassBasis	Real	Enthalpy	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.EnthalpyMassBasis
ColdSideInletH2MoleConcentration	Real	Concentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.DefinedPointPhysicalProperties.Hydrog
ColdSideInletH2SMoleConcentration	Real	Concentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.DefinedPointPhysicalProperties.Hydrog
ColdSideInletInertMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"].Flow.NonCondensibles.MolecularWeight
ColdSideInletMassQuality	Real	Fraction	MaterialPorts[ThermalAllocation="ColdIn"].Flow.VapourPhaseMassFraction
ColdSideInletPressure	Real	Pressure abs	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.Pressure
ColdSideInletTemperature	Real	Temperature tmp	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.Temperature
ColdSideInletVaporH2MFLOW	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdIn"].Flow.VapourPhaseDefinedPointPhysicalProperties.Hy
ColdSideInletVaporH2MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"].Flow.VapourPhaseDefinedPointPhysicalProperties.Hy
ColdSideInletVaporH2OMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"].Flow.VapourPhaseDefinedPointPhysicalProperties.H2
ColdSideInletVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdIn"].Flow.VapourPhaseDefinedPointPhysicalProperties.Hy
ColdSideInletVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"].Flow.VapourPhaseDefinedPointPhysicalProperties.Hy
ColdSideLiquidHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
ColdSideMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.MassFlowRate
ColdSideMolecularWeight	Real	Molar Mass	MaterialPorts[ThermalAllocation="ColdIn"].Flow.BulkFlow.MolecularWeight
ColdSideOutletEnthalpyMassBasis	Real	Enthalpy	MaterialPorts[ThermalAllocation="ColdOut"].Flow.BulkFlow.EnthalpyMassBasis
ColdSideOutletH2MoleConcentration	Real	Concentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdOut"].Flow.BulkFlow.DefinePointPhysicalProperties.Hydrog
ColdSideOutletH2SMoleConcentration	Real	Concentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdOut"].Flow.BulkFlow.DefinePointPhysicalProperties.H2sMo
ColdSideOutletInertMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"].Flow.NonCondesibles.MolecularWeight

FIG. 4D

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ColdSideOutletMassQuality	Real	Fraction	MaterialPorts[ThermalAllocation="ColdOut"].Flow.VapourPhase.MassFraction
ColdSideOutletPressure	Real	Pressure abs	MaterialPorts[ThermalAllocation="ColdOut"].Flow.BulkFlow.Pressure
ColdSideOutletTemperature	Real	Temperature tmp	MaterialPorts[ThermalAllocation="ColdOut"].Flow.BulkFlow.Temperature
ColdSideOutletVaporH2MassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdOut"].Flow.VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporH2MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"].Flow.VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporH2OMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"].Flow.VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdOut"].Flow.VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"].Flow.VapourPhaseDefinedPointPhysicalProperties H
ColdSidePhaseIndicator	eForm(MaterialFlowSpe		MaterialPorts[ThermalAllocation="ColdOut"].Flow.Form
ColdSidePressureDrop	Real	Pressure Diff	ColdSide.NormalOperatingCriteria.PressureDrop
ColdSidePressureDropAllowable	Real	Pressure Diff	ColdSide.MaximumDesignCriteria.AllowablePressureDrop
ColdSidePressureDropInNozzlesAllowable	Real		
ColdSideTestPressure	Real	Pressure abs	
ColdSideTestPressure	Real	Pressure abs	
ColdSideTwoPhaseHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
ColdSideVacuumPressure	Real	Pressure vacuum	
ColdSideVacuumReferenceTemperature	Real	Temperature tmp	ColdSide,NormalDesignCriteria,Vacuum Temperature
ColdSideVapourHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
ColdSideVelocityMaximumAllowable	Real	Velocity normal	
ColdSideVelocityMinimumAllowable	Real	Velocity normal	
ConnectionDescription	String		Nozzles(*),Description
ConnectionFacing	eFacing(Flange)		Nozzles(*),Flange,Facing
ConnectionMark	String		Nozzles(*),NozzleMark
ConnectionNumberRequired	Integer		Nozzles(*),NumberRequired

FIG. 4E

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ConnectionRating	eRating(Nozzle)		Nozzles(*),Rating
ConnectionScheduleSize	Real	Length	Nozzles(*),NominalSize
CorrectedandweightedMtd	Real	Temperature Diff	PerformanceCriteria,LmtdWeighted
Correctedmtd	Real	Temperature Diff	PerformanceCriteria,LmtdCorrected
CostingUserTag	String		CostData,UserTag
Customer	String		Customer,AbbreviatedName
Description	String		Description
DesignGuidelines	String		DesignGuidelines(1)
DesignShellMeanMetalTemperature	Real	Temperature	Assemblies, ShellSide, Shell, NormalDesignCriteria(1),MetalTemperature
DesignShellPressure	Real	Pressure gauge	Assemblies, ShellSide, Shell, NormalDesignCriteria(1),Pressure
DesignTubeMeanMetalTemperature	Real	Temperature	Assemblies, Bundle,TubeType(1),.NormalDesignCriteria(1),MetalTemperature
DesignTubePressure	Real	Pressure gauge	NormalDesignCriteria(1),Pressure
DesignTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,Tubesheets(1),NormalDesignCriteria(1),MetalTemperature
DirectFieldCost	Real	Currency	CostData,DirectFieldCost
ExchangerIsDoublePipe	Boolean		ExchangerIsDoublePipe
ExchangerType	String		ExchangerType
ExchangerWeightEmpty	Real	Mass	Weights,Empty
ExchangerWeightFullOfWater	Real	Mass	Weights,WaterFilled
ExpansionJointDesignLifeCycles	Integer		Assemblies,ShellSide,ExpansionJoints,DesignLifeCycles
ExpansionJointMaterial	String		Assemblies,ShellSide,Expansion Joints,MaterialOfConstruction,MaterialName
ExpansionJointRequired	Boolean		Assemblies,ShellSide,Expansion JointsRequired
ExpansionJointType	eType(ExpansionJoint)		Assemblies,ShellSide,ExpansionJoints,JointType
Fabricator	String		Fabricator
FloatingHeadCoverBoltMaterial	String		Assemblies,FloatingHead,CoverBoltMaterial,MaterialName

FIG. 4F

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FloatingHeadCoverMaterial	String		Assemblies,FloatingHead,CoverBoltMaterial,MaterialName
FloatingHeadGasketMaintenanceFactor	Real	Pressure abs	Assemblies,FloatingHead,Gasket,MaintenaceFactor
FloatingHeadGasketMaterial	String		Assemblies,FloatingHead,Gasket,MaterialOfConstruction,MaterialName
FloatingHeadGasketThickness	Real	Length small	Assemblies,FloatingHead,Gasket,MaterialOfConstruction,Thickness
FloatingHeadGasketYFactor	Real	Pressure abs	Assemblies,FloatingHead,Gasket,MaterialOfConstruction,MaximumYieldStrength
FrontEndTemaType	eTemaType(ExchangeE		Assemblies,Ends(1),TemaType
GasketsSpareSetsRequired	Integer		Assemblies,Gasket,NumberOfSpares
GeneralOfficeOverhead	Real	Currency	CostData,GeneralOfficeOverhead
HeatExchanged	Real	Power normal	PerformanceCriteria,PerformanceData(),HeatDuty
HeatTransferRateClean	Real	Heat Transfer Coef	PerformanceCriteria,OverallCoefficientClean
HeatTransferRateFouled	Real	Heat Transfer Coef	PerformanceCriteria,OverallCoefficientFouled
HeatTransferRateRequired	Real	Heat Transfer Coef	PerformanceCriteria,OverallHeatTransferCoefficient
HotInletStream	MaterialFlowSpecification		MaterialPorts[ThermalAllocation="HotIn"],Flow
HotOutletStream	MaterialFlowSpecification		MaterialPorts[ThermalAllocation="HotOut"],Flow
HotSideDesignPressure	Real	Pressure abs	HotSide,NormalDesignCriteria,Pressure
HotSideDesignTemperature	Real	Temperature tmp	HotSide,NormalDesignCriteria,Temperature
HotSideEnthalpy	Real	Enthalpy	HotSide,HeatingCoolingCurve(1),DataPoints(*),BulkFlow,ThermodynamicProperties,SpecificEntha
HotSideFlangeFacing	String		HotSide,FlangeFacing
HotSideFlangeFacing	String		HotSide,FlangeFacing
HotSideFlangeRating	String		HotSide,FlangeRating
HotSideFluidAllocation	eHotFluidAllocation(Shel		NormalDesignCriteria(1),HotFluidAllocation
HotSideFluidName	String		MaterialPorts[ThermalAllocation="HotIn"],Flow,Name
HotSideFoulingResistance	Real	Thermresist POT	HotSide,FoulingResistance
HotSideFoulingThickness	Real	Lengthsmall	HotSide,FoulingThickness

FIG. 4G

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HotSideFullVacuum	Boolean	HotSide,NormalDesignCriteria,FullVacuum
HotSideFullVacuumReferenceTemperature	Real	Tempreature tmp	HotSide,NormalDesignCriteria,VacuumTemperature
HotSideGasketMaterial	String	
HotSideHeatBalanceMethod	String	
HotSideHeatCurves	ExchangerFluidProfile	HotSide,FluidProfiles(*)
HotSideInletEnthalpyMassBasis	Real	Enthalpy	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,EnthalpyMassBasis
HotSideInlet2MoleConcentration	Real	Conc. % mol/mol	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,DefinedPointPhysicalProperties,Hydroge
HotSideInlet2SMoleConcentration	Real	Conc. % mol/mol	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,DefinedPointPhysicalProperties,H2sMole
HotSideInletInertMW	Real	MolarMass (g/mol)	MaterialPorts[ThermalAllocation="HotIn"],Flow,NonCondesibles,MolecularWeight
HotSideInletMassQuality	Real	Fraction	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,MassFraction
HotSideInletPressure	Real	Pressure abs	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,Pressure
HotSideInletTemperature	Real	Temperature tmp	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,Temperature
HotSideInletVaporFlowrate	Real	Mass flow small	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,MassFlowRate
HotSideInletVaporH2MassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideInletVaporH2MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideInletVaporH20MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideInletVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideInletVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotIn"],Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideLiquidHeatTransferCoefficientSpecified	Real	Heat Transfer Coef
HotSideMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,MassFlowRate
HotSideMolecularWeight	Real	Molar Mass	MaterialPorts[ThermalAllocation="HotIn"],Flow,BulkFlow,MolecularWeight
HotSideOutletEnthalpyMassBasis	Real	Enthalpy	MaterialPorts[ThermalAllocation="HotOut"],Flow,BulkFlow,EnthalpyMassBasis
HotSideOutletH2MoleConcentration	Real	Conc. % mol/mol	MaterialPorts[ThermalAllocation="HotOut"],Flow,BulkFlow,DefinedPointPhysicalProperties,Hydro
HotSideOutletH2SMoleConcentration	Real	Conc. % mol/mol	MaterialPorts[ThermalAllocation="HotOut"],Flow,BulkFlow,DefinedPointPhysicalProperties,H2sMo

FIG. 4H

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HotSideOutletInertMW	Real	MolarMass (g/mol)	MaterialPorts[ThermalAllocation="HotOut"],Flow,NonCondesibles,MolecularWeight
HotSideOutletMassQuality	Real	Fraction	MaterialPorts[ThermalAllocation="HotOut"],Flow,VapourPhase,MassFraction
HotSideOutletPressure	Real	Pressure abs	MaterialPorts[ThermalAllocation="HotOut"],Flow,BulkFlow,Pressure
HotSideOutletTemperature	Real	Temperature	MaterialPorts[ThermalAllocation="HotOut],Flow,BulkFlow,Temperature
HotSideOutletVaporH2MassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotOut"],Flow,VapourPhase,DefinedPoint,PhysicalProperties.Hy
HotSideOutletVaporH2MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotOut"],Flow,VapourPhase,DefinedPoint,PhysicalProperties.Hyd
HotSideOutletVaporH20MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotOut"],Flow,VapourPhase,DefinedPointPhysicalProperties,H2
HotSideOutetVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotOut"],Flow,VapourPhase,DefinedPointPhysicalProperties,Hy
HotSideOutetVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotOut"],Flow,VapourPhase,DefinedPointPhysicalProperties,Hy
HotSidePhaseIndicator	eForm(MaterialFlowSpec		MaterialPorts[ThermalAllocation="HotIn"],Flow,Form
HotSidePressureDrop	Real	Presure Diff	HotSide,NormalOperatingCriteria,PressureDrop
HotSidePressureDropAllowable	Real	Presure Diff	HotSide,MaximumDesignCriteria,AllowablePressureDrop
HotSidePressureDropInNozzlesAllowable	Real		
HotSideTestPressure	Real	Pressure abs	
HotSideTwoPhaseHeatTransferCoefficientSpecif	Real	Heat Transfer Coef	
HotSideVacuumPressure	Real	Pressure vacuum	
HotSideVapourHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
HotSideVelocityMaximumAllowable	Real	Velocity normal	
HotSideVelocityMinimumAllowable	Real	Velocity normal	
HydroTestPressureField	Real	Absolute Pressure	InspectionsAndTests,HydrostaticTestPressureField
HydroTestPressureShop	Real	Absolute Pressure	InspectionsAndTests,HydrostaticTestPressureShop
ImpingementProtection	Boolean		Assemblies Bundle,ImpingementProtection
ImpingementProtectionType	ePlateType/Impingemen		Assemblies Bundle,ImpingementPlate,PlateType

FIG. 4I

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ImpingementProtectionType	ePlateType(Impingemen		Assemblies,Bundle,ImpingementPlate,PlateType
InletNozzleRv2	Real	Density Velocity Sq	Assemblies,PerformanceCriteria,ShellsidePerformance,LimitInletRhov2
InnerDiameter	Real	Length normal	Assemblies,ShallSide,InnerDiameter
InsulationDensity	Real	Density	Insulation,Density
InsulationMaterial	String		Insulation,MaterialName
InsulationPurpose	String		Insulation,Purpose
InsulationSpecification	String		Insulation,Specification
InsulationThickness	Real	Length small	Insulation,Thickness
ItemNumber	String		ItemNumber
JobNo	String		JobNumber
KettleDiameterInner	Real	Length small	
KettleDiameterOuter	Real	Length small	
Location	String		Location,Site
LongitudinalBaffleSealType	eSealType(LongitudinalB		Assemblies,Bundle,LongitudinalBaffles,SealType
LongitudinalBaffleType	String		Assemblies,Bundle,LongitudinalBaffles,Type
Manufacturer	String		Manufacturer
MaterialComponentCost	Real	Currency	CostData,MaterialComponentCost
MAWPCalculation	Boolean		CalculateMAWP
MAWPHotAndCorroded	Real	Pressure abs	MAWPHotAndCorroded
MAWPNewAndCold	Real	Pressure abs	MAWPNewAndCold
ModelNumber	String		ModelNumber
NormalShellMeanMetalTemperature	Real	Temperature	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),MetalTemperature
NormalShellPressure	Real	Pressure gauge	NormalContent,BulkAmount,Pressure
NormalTubeMeanMetalTemperture	Real	Temperature	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),MetalTemperature

FIG. 4J

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NormalTubePressure	Real	Pressure gauge	NormalContents,BulkAmount,Pressure
NormalTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies Bundle, TubeType(1), NormalDesignCriteria(1),MetalTemperature
Notes	String		Notes(*)
NumberOfCrossPasses	Integer		Assemblies Bundle,NumberOfCrosspasses
NumberOfUnits	Integer		NumberInService
NumberRequired	Integer		NumberRequired
Orientation	String		Orientation
PONumber	String		PoNumber
PressureShellDesignGuage	Real	Pressure gauge	NormalDesignCriteria(1),ShellsideDesign,Pressure
PressureTubeDesignGuage	Real	Pressure gauge	NormalDesignCriteria(1),ShellsideDesign,Pressure
PressureUnit	String		CompleteItemNumber
Profit	Real	Currency	CostData,Profit
QuotedCost	Real	Currency	CostData,QuotedCost
RearEndTemaType	eTemaType(Exchangert		Assemblies,Ends(2),TemaType
ReasonsForStressRelief	String		InspectionAndTests,ReasonsForStressRelief
RefNamelcarus	String		CostingReference
SealingStripNumberOfPairs	Integer		Assemblies,Bundle,NumberOfSealStrips
SealingStripTubeRowsPer	Real		
ServiceOfUnit	String		Function
ShellAndTubeOnEquipmentSpecification	Boolean		ShellAndTubeOnEquipmentSpecification
ShellAndTubeOnProcessSpecificSS	Boolean		ShellAndTubeOnProcessSpecificSS
ShellBodyFlangeCorrosionAllowance	Real	Length small	Assemblies,ShellSide,BodyFlangeMaterial,CorrosionAllowance
ShellBodyFlangeMaterial	String		Assemblies,ShellSide,BodyFlangeMaterial,MaterialName
ShellCorrosionAllowance	Real	Length Inches	NormalDesignCriteria(1),ShellsideDesign,AllowableCorrosionAllowance

FIG. 4K

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ShellCoverMaterial	String		Assembles,ShellSide,CoverMaterial,MaterialName
ShellDiameterIncrements	Real		NormalDesignCriteria,ShellsideDesign,ShellDiameterIncrement
ShellDiameterInner	Real	Length	Assemblies,ShellSide,Shell,InnerDiameter
ShellDiameterMaximum	Real	Length small	MaximumDesignCriteria,ShellsideDesign,MaximumShellDiameter
ShellDiameterMinimum	Real	Length small	NormalDesignCriteria(1),ShellsideDesign,AllowableCorrosionAllowance
ShellDiameterMinimum	Real	Length small	NormalDesignCriteria(1),ShellsideDesign,AllowableCorrosionAllowance
ShellDiameterOuter	Real	Length	Assemblies,ShellSide,OuterDiameter
ShellExpansionJoint	String		Assemblies,ShellSide,ExpansionJoints,MaterialOfConstruction,MaterialName
ShellExpansionJointCorrosionAllowance	Real	Length	Assemblies,ShellSide,ExpansionJoints,MaterialOfConstruction,CorrosionAllowance
ShellExternalBoltingCorrosionAllowance	Real	Length small	Assemblies,ShellSide,ExternalBoltingMaterial,CorrosionAllowance
ShellExternalBoltingMaterial	String		Assemblies,ShellSide,ExternalBoltingMaterial,MaterialName
ShellHeadCorrosionAllowance	Real	Length	Assemblies,ShellSide,Shell,Heads(1),MaterialOfConstruction,CorrosionAllowance
ShellHeadMaterial	String		Assemblies,ShellSide,Shell,Heads(1),MaterialOfConstruction,MaterialName
ShellInternalBoltingCorrosionAllowance	Real	Length small	Assemblies,ShellSide,InternalBoltingMaterial,CorrosionAllowance
ShellInternalBoltingMaterial	String		Assemblies,ShellSide,InternalBoltingMaterial,MaterialName
ShellMaterial	String		Assemblies,ShellSide,Shell,MaterialOfConstruction,MaterialName
ShellMaterialClass	String		Assemblies,ShellSide,MaterialOfConstruction,MaterialClass
ShellNozzleFlangeCorrosionAllowance	Real	Length small	Assemblies,ShellSide,NozzleFlangeMaterial,CorrosionAllowance
ShellNozzleFlangeMaterial	String		Assemblies,ShellSide,NozzleFlangeMaterial,MaterialName
ShellNozzleNeckMaterial	String		Assemblies,ShellSide,NozzleNeckMaterial,MaterialName
ShellNozzleNecksCorrosionAllowance	Real	Length small	Assemblies,ShellSide,NozzleNeckMaterial,CorrosionAllowance
ShellNozzleReinforcementCorrosionAllowance	Real	Length	Assemblies,ShellSide,Shell,Nozzles(1),MaterialOfConstruction,CorrosionAllowance
ShellNozzleReinforementMaterial	String		Assemblies,ShellSide,Shell,Nozzles(1),Reinforced
ShellPassesNumberPerShell	Integer		Assemblies,ShellSide,Shell,NumberShellPasses

FIG. 4L

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ShellPipeandStubEndCorrosionAllowance	Real	Length small	Assemblies,ShellSide,PipeAndStubEndMaterial,CorrosionAllowance
ShellPipeandStubEndMaterial	String		Assemblies,ShellSide,PipeAndStubEndMaterial,MaterialName
ShellSideAverageFilmCoefficient	Real	Heat Transfer Coef	Assemblies,PerformanceCriteria,ShellsidePerformance,BulkFilmCoefficient
ShellSideCleaning	String		Assemblies,ShellSide,MechanicalCleaning
ShellSideCorrosionAllowance	Real	Length	Assemblies,ShellSide,MaterialConstruction,CorrosionAllowance
ShellSideCrossflowFraction	Real	Fraction	
ShellSideDesignPressure	Real	Pressure gauge	Assemblies,ShellSide,NormalDesignCriteria(1),Pressure
ShellSideDesignPressureMaximum	Real	Pressure abs	Assemblies,ShellSide,MaximumDesignCriteria,Pressure
ShellSideDesignTemperature	Real	Temperature	Assemblies,ShellSide,NormalDesignCriteria(1),Temperature
ShellSideDesignTemperatureMaximum	Real	Temperature tmp	Assemblies,ShellSide,MaximumDesignCriteria,Temperature
ShellSideDrainNozzleNumber	Integer		Assemblies,ShellSide,Nozzles["NozzleFunction="Drain"],Number
ShellSideDrainNozzleRating	eNozzleRating2_PIP VEI		Assemblies,ShellSide,Nozzles["NozzleFunction="Drain"],Rating
ShellSideDrainNozzleSize	Real	Length	Assemblies,ShellSide,Nozzles["NozzleFunction="Drain"],NominalSize
ShellSideFluidName	String		MaterialPorts[PhysicalAllocation=ShellIn],Flow,Name
ShellSideFoulingCoefficient	Real	Heat Transfer Coef	Assemblies,PerformanceCriteria,ShellsidePerformance,FoulingCoefficient
ShellSideFoulingResistance	Real	Thermal Reistance	Assemblies,PerformanceCriteria,ShellsidePerformance,FoulingResistance
ShellSideGasketMaintenanceFactor	Real	Pressure abs	Assemblies,ShellSide,Gasket,MaintenanceFactor
ShellSideGasketMaterial	String		Assemblies,Gasket,MaterialOfConstruction,MaterialName
ShellSideGasketThickness	Real	Length small	Assemblies,ShellSide,Gasket,BodyMaterial,Thickness
ShellSideGasketVFactor	Real	Pressure abs	Assemblies,ShellSide,Gasket,MinimumDesignSeatingStress
ShellSideInletNozzleInsideDiameter	Real	Length small	Assemblies,ShellSide,Nozzles[NozzleFunction="Inlet"],Bore
ShellSideInletNozzleNumber	Integer		Assemblies,ShellSide,Nozzles[NozzleFunction="Inlet"],Number
ShellSideInletNozzleRating	eNozzleRating1_PIP VEI		Assemblies,ShellSide,Nozzles[NozzleFunction="Inlet"],Rating
ShellSideInletNozzleRhoV2	Real	Density VelocitySq	Assemblies,ShellSide,Nozzles[NozzleFunction="Inlet"],RhoV2

FIG. 4M

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ShellSideInletNozzleSize	Real	Length	Assemblies,ShellSide,Nozzles[NozzleFunction="Inlet"],NominalSize
ShellSideInletNozzleType	String		Assemblies,ShellSide,Nozzles[NozzleFunction="Inlet"],Type
ShellSideInletPressure	Real	Pressure abs	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,Pressure
ShellSideInletTemperature	Real	Temperature tmp	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,Temperature
ShellSideIntermediateNozzleNumber	Integer		Assemblies,ShellSide,Nozzles[NozzleFunction="Intermediate"],Number
ShellSideIntermediateNozzleRating	eNozzleRating1_PIP VEC		Assemblies,ShellSide,Nozzles[NozzleFunction="Intermediate"],Rating
ShellSideIntermediateNozzleRhoV2	Real	Density Velocity Sq	Assemblies,ShellSide,Nozzles[NozzleFunction="Intermediate"],RhoV2
ShellSideIntermediateNozzleSize	Real	Length	Assemblies,ShellSide,Nozzles[NozzleFunction="Intermediate"],NominalSize
ShellSideIntermediateNozzleType	String		Assemblies,ShellSide,Nozzles[NozzleFunction="Intermediate"],Type
ShellSideLatentHeat	Real	Latent heat normal	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,ThermodynamicProperties,HeatOfVapo
ShellSideLatentHeat	Real	Latent heat normal	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,ThermodynamicProperties,HeatOfVapo
ShellSideLatentHeatReferenceTemperature	Real	Temperature	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,TransportProperties,ReferenceTemper
ShellSideLiquidInletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Liquid1Phase,PvtProperties,DensityMassBasis
ShellSideLiquidInletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Liquid1Phase,MassFlowRate
ShellSideLiquidInletSpecificHeat	Real	Spec Heat Cap (Ma	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Liquid1Phase,ThermodynamicProperties,HeatCa
ShellSideLiquidInletSurfaceTension	Real	Surface Tension	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Liquid1Phase,TransportProperties,SurfaceTensio
ShellSideLiquidInletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Liquid1Phase,TransportProperties,ThermalCond
ShellSideLiquidInletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Liquid1Phase,TransportProperties,Viscosity
ShellSideLiquidOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Liquid1Phase,PvtProperties,DensityMassBasis
ShellSideLiquidOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Liquid1Phase,MassFlowRate
ShellSideLiquidOutletNozzleInsideDiameter	Real	Length small	Assemblies,ShellSide,Nozzles[NozzleFunction="LiquidOutlet"],Bore
ShellSideLiquidOutletNozzleNumber	Integer		Assemblies,ShellSide,Nozzles[NozzleFunction="LiquidOutlet"],Number
ShellSideLiquidOutletNozzleRating	eNozzleRating1_PIP VEC		Assemblies,ShellSide,Nozzles[NozzleFunction="LiquidOutlet"],Rating
ShellSideLiquidOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,ShellSide,Nozzles[NozzleFunction="LiquidOutlet"],RhoV2

FIG. 4N

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ShellSideLiquidOutletNozzleType	String		Assemblies,ShellSide,Nozzles[NozzleFunction="LiquidOutlet"],Bore
ShellSideLiquidOutletSpecificHeat	Real	Spec Heat Cap (Ma	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Liquid1Phase,ThermodynamicProperties,HeatO
ShellSideLiquidOutletSurfaceTension	Real	Surface tension PQ	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Liquid1Phase,TransportProperties,SurfaceTens
ShellSideLiquidOutletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Liquid1Phase,TransportProperties,ThermalCon
ShellSideLiquidOutletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Liquid1Phase,TransportProperties Viscosity
ShellSideMinimumDesignMetalTemperature	Real	Temperature	Assemblies,ShellSide,MinimumDesignCriteria(1),MetalTemperature
ShellSideNoncondensableInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,NonCondesible,MassFlowRate
ShellSideNoncondensableInletMw	Real	Molar Mass	6MaterialPorts[PhysicalAllocation="ShellIn"],Flow,NonCondesible,MolecularWeight
ShellSideNoncondensableOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,NonCondesible,MassFlowRate
ShellSideNoncondensableOutletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,NonCondesible,PvtProperties,MolecularWeig
ShellSideNumberOfPassesPerShell	Integer		Assemblies,ShellSide,NumberOfPasses
ShellSideOutletNozzleInsideDiameter	Real	Length small	Assemblies,ShellSide,Nozzles[NozzleFunction="Outlet"],Bore
ShellSideOutletNozzleNumber	Integer		Assemblies,ShellSide,Nozzles[NozzleFunction="Outlet"],Number
ShellSideOutletNozzleRating	eNozzleRating1_PIP VEC		Assemblies,ShellSide,Nozzles[NozzleFunction="Outlet"],Rating
ShellSideOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,ShellSide,Nozzles[NozzleFunction="Outlet"],RhoV2
ShellSideOutletNozzleSize	Real	Length	Assemblies,ShellSide,Nozzles[NozzleFunction="Outlet"],NominalSize
ShellSideOutletNozzleType	String		Assemblies,ShellSide,Nozzles[NozzleFunction="Outlet"],Type
ShellSideOutletTemperature	Real	Temperature tmp	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,BulkFlow,Temperature
ShellSidePressureDropAllowable	Real	Pressure Diff	Assemblies,ShellSide,NormalOperatingCriteria(1),PressureDrop
ShellSidePressureDropCalculated	Real	Pressure Diff	Assemblies,ShellSide,NormalOperatingCriteria(2),PressureDrop
ShellSideSteamInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,Steam,MassFlowRate
ShellSideSteamOutletFlow	Real	Mass flow normal	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,Steam,MassFlowRate
ShellSideTestPressure	Real	Pressure abs	Assemblies,ShellSide,InspectionAndTests,HydrostaticTestPressure
ShellSideTotalFluidQuantity	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,MassFlowRate

FIG. 4O

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ShellSideVaporInletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,VapourPhase,PvtProperties,DensityMassBasis
ShellSideVaporInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,VapourPhase,MassFlowRate
ShellSideVaporInletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,VapourPhase,MolecularWeight
ShellSideVaporInletSpecificHeat	Real	Spec Heat Cap (Ma	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,VapourPhase,ThermodynamicProperties,HeatCa
ShellSideVaporInletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,VapourPhase,TransportProperties,ThermalCond
ShellSideVaporInletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,VapourPhase,TransportProperties,Viscosity
ShellSideVaporOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,PvtProperties,DensityMassBasis
ShellSideVaporOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,MassFlowRate
ShellSideVaporOutletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,PvtProperties,MolecularWeight
ShellSideVaporOutletNozzleNumber	Integer		Assemblies,ShellSide,Nozzles[NozzleFunction="VapourOutlet"],Number
ShellSideVaporOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,ShellSide,Nozzles[NozzleFunction="VapourOutlet"],RhoV2
ShellSideVaporOutletNozzleSize	Real	Length small	Assemblies,ShellSide,Nozzles[NozzleFunction="VapourOutlet"],NominalSize
ShellSideVaporOutletNozzleType	String		Assemblies,ShellSide,Nozzles[NozzleFunction="VapourOutlet"],Type
ShellSideVaporOutletSpecificHeat	Real	Spec Heat Cap (Ma	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,ThermodynamicProperties,HeatC
ShellSideVaporOutletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,TransportProperties,ThermalCon
ShellSideVaporOutletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,TransportProperties,ThermalCon
ShellSideVaporOutletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,VapourPhase,TransportProperties,Viscosity
ShellSideVelocity	Real	Velocity	Assemblies,PerformanceCriteria,ShellsidePerformance,MidpointVelocity
ShellSideVelocityMaximum	Real	Velocity small	Assemblies,NormalDesignCriteria,ShellsideDesign,MaximumVelocity
ShellSideVentNozzleNumber	Integer		Assemblies,ShellSide,Nozzles[NozzleFunction="Vent"],Number
ShellSideVentNozzleRating	eNozzleRating2_PIP VEI		Assemblies,ShellSide,Nozzles[NozzleFunction="Vent"],Rating
ShellSideVentNozzleSize	Real	Length	Assemblies,ShellSide,Nozzles[NozzleFunction="Vent"],NominalSize
ShellSideWaterInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,CoolingWater,MassFlowRate
ShellSideWaterOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,CoolingWater,MassFlowRate

FIG. 4P

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ShellsInParallelMaximum	Integer		NormalDesignCriteria(1),MaximumShellsInParallel
ShellsInParallelMinimum	Integer		NormalDesignCriteria(1),MinimumShellsInParallel
ShellsInParallelNumber	Integer		NumberShellsinParallel
ShellsInSeriesMaximum	Integer		NumberDesignCriteria(1),MaximumShellsInSeries
ShellsInSeriesMinimum	Integer		NormalDesignCriteria(1),MinimumShellsInSeries
ShellsInSeriesNumber	Integer		NumberShellsinSeries
ShellsMultiple	Boolean		MultipleShells
Shellsperunit	Integer		NumberShellsPerUnit
ShellSupportsCorrosionAllowance	Real	Length small	Assemblies,ShellSide,Shell,Support,MaterialOfConstruction,CorrosionAllowance
ShellSupportsMaterial	String		Assemblies,ShellSide,Shell,Support,MaterialOfConstruction,MaterialName
ShellTEMAType	eShellTEMAType		Assemblies,ShellSide,TemaShellType
ShellThickness	Real	Length small	Assemblies,ShellSide,Shell,Thickness
ShellThicknessMinimum	Real	Length	
ShopManpowerCost	Real	Currency	CostData,ShopManpowerCost
ShopOverhead	Real	Currency	CostData,ShopOverhead
ShutdownShellMeanMetalTemperature	Real	Temperature	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),MetalTemperature
ShutdownShellPressure	Real	Pressure gauge	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),Pressure
ShutdownTubeMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),MetalTemperature
ShutdownTubePressure	Real	Pressure gauge	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),Pressure
ShutdownTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,Tubesheets(1),NormalDesignCriteria(1),MetalTemperature
ShutupShellMeanMetalTemperature	Real	Temperature	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),MetalTemperature
StartupShellPressure	Real	Pressure gauge	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),Pressure
StartupTubeMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),MetalTemperature
StartupTubePressure	Real	Pressure gauge	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),Pressure

FIG. 4Q

34

StartupTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,TubeSheets(1),NormalDesignCriteria(1),MetalTemperature
Status	String		Status
SteamOutShellMeanMetalTemperature	Real	Temperature	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),SteamOutTemperature
SteamOutShellPressure	Real	Pressure gauge	Assemblies,ShellSide,Shell,NormalDesignCriteria(1),SteamOutPressure
SteamOutShellRequirement	Boolean		Assemblies,ShellSide,Shell,NormalDesignCriteria,SteamOutRequirement
SteamOutTemperature	Real	Temperature	Assemblies,ShellSide,Shell,NormalDesignCriteria,SteamOutTemperature
SteamOutTubeMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),SteamOutTemperature
SteamOutTubePressure	Real	Pressure gauge	Assemblies,Bundle,TubeType(1),NormalDesignCriteria(1),SteamOutPressure
SteamOutTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies,Bundle,Tubesheets(1),NormalDesignCriteria(1),SteamOutPressure
SurfaceExcessMinimum	Real	Area normal	
SurfacePerShellEffective	Real	Area normal	Assemblies,Bundle,ShellSide,EffectiveArea
SurfacePerUnitEffective	Real	Area	EffectiveSurfacePerUnit
SurfacePerUnitRequired	Real	Area normal	RequiredSurfacePerUnit
TEMAClass	eTemaClass(ShellAndTui		TEMAClass
TEMAOrientation	eTemaOrientation PIP \		TEMAOrientation
TEMARemarks	String		TEMARemarks
TEMASize	String		Status
TEMAType	String		Type
TemperatureShellDesign	Real	Temperature tmf	NormalDesignCriteria(1),ShellsideDesign,Temperature
TemperatureTubeDesign	Real	Temperature tmf	NormalDesignCriteria(1),ShellsideDesign,Temperature
TemperatureTubeDesign	Real	Temperature tmf	NormalDesignCriteria(1),TubesideDesign,Temperature
TerminalStreams	MaterialFlowSpecification		MaterialPorts(*),PipingSystem
TestRingRequired	Boolean		InpsectionAndTests,TestRingRequired
ThicknessShell	Real	Length small	Assemblies,ShellSide,Thickness

FIG. 4R

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TotalCost	Real	Currency	CostData.TotalCost
TubeBaffleDiametralClearance	Real	Length normal	Assemblies,Bundle,TubeToBaffleClearance
TubeBWGAverage	Integer		Assemblies,Bundle,TubeType(1),BirminghamWireGauge
TubeBWGMinimum	Integer		Assemblies,Bundle,TubeType(1),BirminghamWireGaugeMinimum
TubeCorrosionAllowance	Real	Length Inches	NormalDesignCriteria(1),TubesideDesign,AllowableCorrosionAllowance
TubeFinDiameterOuter	Real	Length Inches	Assemblies,Bundle,TubeType(1),Externals,OuterDiameter
TubeFinDiameterRoot	Real	Length normal	Assemblies,Bundle,TubeType(1),Externals,RootDiameter
TubeFinHeight	Real	Length normal	Assemblies,Bundle,TubeType(1),Externals,Height
TubeFinMaterial	String		Assemblies,Bundle,TubeType(1),Externals,MaterialOfConstruction,MaterialName
TubeFinPerUnitLength	Real	Inverse length	Assemblies,Bundle,TubeType(1),Externals,NumberOfFinsPerUnitLength
TubeFinPitch	Real	Length normal	Assemblies,Bundle,TubeType(1),Externals,FinPitch
TubeFinThickness	Real	Length normal	Assemblies,Bundle,TubeType(1),Externals,AverageThickness
TubeInletEndlength	Real	Length normal	Assemblies,Bundle,TubeType(1),InletEndlength
TubeInnerDiameter	Real	Length small	Assemblies,Bundle,TubeType(1),InnerDiameter
TubeLayout	eTubeLayout(Exchange		Assemblies,Bundle,TubeLayout
TubeLayoutAltemate	eTubeLayout(Exchange		Assemblies,Bundle,TubeLayoutAltemate
TubeLayoutSpec	eTubeLayout(Exchange		Assemblies,Bundle,TubeLayoutSpec
TubeLength	Real	Length	Assemblies,Bundle,TubeType(1),TotalLength
TubeLengthIncrement	Real	Length small	NormalDesignCriteria(1),TubesideDesign,TubeLengthIncrement
TubeLengthMaximum	Real	Length small	NormalDesignCriteria(1),TubesideDesign,MaximumTubeLength
TubeLengthMinimum	Real	Length small	NormalDesignCriteria(1),TubesideDesign,MinimumTubeLength
TubeLengthStraight	Real	Length normal	Assemblies,Bundle,TubeType(1),StraightLength
TubeLengthUnfinnedAtBaffles	Real	Length	
TubeMaterial	String		Assemblies,Bundle,TubeType(1),MaterialOfConstruction,MaterialName

FIG. 4S

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TubeMaterialClass	String		Assemblies,Bundle,TubeType(1),MaterialOfConstruction,MaterialName
TubeMaterialDensity	Real	Density	Assemblies,Bundle,TubeType(1),MaterialOfConstruction,Density
TubeNumber	Integer		Assemblies,Bundle,TotalNumberOfTubes
TubeOuterDiameter	Real	Length	Assemblies,Bundle,TotalType(1),OuterDiameter
TubeOuterDiameterAltemate	Real	Length small	Assemblies,Bundle,TubeType(1),OuterDiameterAltemate
TubeOuterEndlength	Real	Length normal	Assemblies,Bundle,TubeType(1),OuterEndlength
TubePassesIncrement	String		
TubePassesNumberPerShell	Integer		Assemblies,Bundle,NumberTubePassesPerShell
TubePassesNumberPerShellMaximum	Real		
TubePassesNumberPerShellMinimum	Real		
TubePitch	Real	Length	Assemblies,Bundle,TubePitch
TubePitchAltemate	Real	Length normal	Assemblies,Bundle,TubePitchAltemate
TubeCorrosionAllowance	Real	Length small	Assemblies,Bundle,TubeType(1),MaterialOfConstruction,CorrosionAllowance
TubeSheetFloatingMaterial	String		Assemblies,Bundle,Tubesheets(2),MaterialOfConstruction,MaterialName
TubeSheetCorrosionAllowance	Real	Length	Assemblies,Bundle,Tubesheets(1),MaterialOfConstruction,CorrosionAllowance
TubeSheetsMaterial	String		Assemblies,Bundle,Tubesheets(1),MaterialOfConstruction,MaterialName
TubeSheetThickness	Real	Length	Assemblies,Bundle,Tubesheets(1),MaterialOfConstruction,Thickness
TubeSideAverageFilmCoefficient	Real	Heat Transfer Coef	Assemblies,PerformanceCriteria,TubesidePerformance,BulkFilmCoefficient
TubeSideCleaning	String		Assemblies,Bundle,MechanicalCleaning
TubeSideCorrosionAllowance	Real	Length	Assemblies,Bundle,TubeType(1),MaterialOfConstruction,CorrosionAllowance
TubeSideDesignPressure	Real	Pressure abs	Assemblies,Bundle,NormalDesignCriteria(1),Pressure
TubeSideDesignPressureMaximum	Real	Pressure abs	Assemblies,Bundle,MaximumDesignCriteria,Pressure
TubeSideDesignTemperature	Real	Temperature tmp	Assemblies,Bundle,NormalDesignCriteria(1),Temperature
TubeSideDesignTemperatureMaximum	Real	Temperature tmp	Assemblies,Bundle,MaximumDesignCriteria,Temperature

FIG. 4T

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TubeSideDrainNozzleNumber	Integer		Assemblies,Bundle,Nozzles\NozzleFunction="Drain".Number
TubeSideDrainNozzleNumber	Integer		Assemblies,Bundle,Nozzles\NozzleFunction="Drain".Number
TubeSideDrainNozzleRating	eNozzleRating2_PIP VEC		Assemblies,Bundle,Nozzles\NozzleFunction="Drain".Rating
TubeSideDrainNozzleSize	Real	Length	Assemblies,Bundle,Nozzles\NozzleFunction="Drain".NominalSize
TubeSideFluidName	String		MaterialPorts\PhysicalAllocation=TubeIn].Flow.Name
TubeSideFoulingCoefficient	Real	Heat Transfer Coef	Assemblies,PerformanceCriteria,TubesidePerformance.FoulingCoefficient
TubeSideFoulingResistance	Real	Thermal Resistance	Assemblies,PerformanceCriteria,TubesidePerformance.FoulingResistance
TubeSideGasketMainenanceFactor	Real	Pressure abs	Assemblies,Bundle,Gasket,MaintenaceFactor
TubeSideGasketMaterial	String		Assemblies,Bundle,Gasket,BodyMaterial,MaterialName
TubeSideGasketThickness	Real	Length small	Assemblies,Bundle,Gasket,BodyMaterial,Thickness
TubeSideGasketFactor	Real	Pressure abs	Assemblies,Bundle,Gasket,MinimumDesignSeatingStress
TubeSideInletNozzleAngularPosition	Real	Plane Angle	
TubeSideInletNozzleDistanceFromTubesheet	Real	Length	
TubeSideInletNozzleInsideDiameter	Real	Length small	Assemblies,Bundle,Nozzles\NozzleFunction="Inlet".Bore
TubeSideInletNozzleNumber	Integer		Assemblies,Bundle,Nozzles\NozzleFunction="Inlet".Number
TubeSideInletNozzlePressureDrop	Real	Pressure	
TubeSideInletNozzleRating	eNozzleRating2_PIP VEC		Assemblies,Bundle,Nozzles\NozzleFunction="Inlet".Rating
TubeSideInletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,Bundle,Nozzles\NozzleFunction="Intermediate".RhoV2
TubeSideInletNozzleSize	Real	Length	Assemblies,Bundle,Nozzles\NozzleFunction="Inlet".NominalSize
TubeSideInletNozzleType	String		Assemblies,Bundle,Nozzles\NozzleFunction="Intermediate".Type
TubeSideInletNozzleWallThickness	Real	Length	
TubeSideInletPressure	Real	Pressure abs	MaterialPorts\PhysicalAllocation="TubeIn".Flow.BulkFlow.Pressure
TubeSideInletTemperature	Real	Temperature tmp	MaterialPorts\PhysicalAllocation="TubeIn".Flow.BulkFlow.Temperature
TubeSideIntermediateNozzleNumber	Integer		Assemblies,Bundle,Nozzles\NozzleFunction="Intermediate".Number

FIG. 4U

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TubeSideIntermediateNozzleRating	eNozzleRating2_PIP VEC		Assemblies,Bundle,Nozzles[NozzleFunction="Intermediate"].Rating
TubeSideIntermediateNozzleRhoV2	Real	Density Velocity Sq	Assemblies,Bundle,Nozzles[NozzleFunction="Intermediate"].RhoV2
TubeSideIntermediateNozzleSize	Real	Length	Assemblies,Bundle,Nozzles[NozzleFunction="Intermediate"].NominalSize
TubeSideIntermediateNozzleType	String		Assemblies,Bundle,Nozzles[NozzleFunction="Intermediate"].Type
TubeSideLatentHeat	Real	Latent heat normal	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,BulkFlow,ThermodynamicProperties,HeatOfVapo
TubeSideLatentHeatReferenceTemperature	Real	Temperature	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,BulkFlow,TransportProperties,ReferenceTemper
TubeSideLiquidInletDensity	Real	Density	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,Liquid1Phase,PvtProperties,DensityMassBasis
TubeSideLiquidInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,Liquid1Phase,MassFlowRate
TubeSideLiquidInletSpecificHeat	Real	Spec Heat Can (MB	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,Liquid1Phase,ThermodynamicProperties,HeatCa
TubeSideLiquidInletSurfaceTension	Real	Surface Tension	
TubeSideLiquidInletThermalConductivity	Real	Thermal Conductiv	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,Liquid1Phase,TransportProperties,ThermalCond
TubeSideLiquidInletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="TubeIn"].Flow,Liquid1Phase,TransportProperties,Viscosity
TubeSideLiquidOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="TubeOut"].Flow,Liquid1Phase,PvtProperties,DensityMassBasis
TubeSideLiquidOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeOut"].Flow,Liquid1Phase,MassFlowRate
TubeSideLiquidOutletNozzleInsideDiameter	Real	Length small	Assemblies,Bundle,Nozzles[NozzleFunction="LiquidOutlet"].Bore
TubeSideLiquidOutletNozzleNumber	Integer		Assemblies,Bundle,Nozzles[NozzleFunction="LiquidOutlet"].Number
TubeSideLiquidOutletNozzleRating	eNozzleRating2_PIP VEC		Assemblies,Bundle,Nozzles[NozzleFunction="LiquidOutlet"].Rating
TubeSideLiquidOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,Bundle,Nozzles[NozzleFunction="LiquidOutlet"].RhoV2
TubeSideLiquidOutletNozzleSize	Real	Length small	Assemblies,Bundle,Nozzles[NozzleFunction="LiquidOutlet"].NominalSize
TubeSideLiquidOutletNozzleType	String		Assemblies,Bundle,Nozzles[NozzleFunction="LiquidOutlet"].Type
TubeSideLiquidOutletSpecificHeat	Real	Spec Heat Cap (Ma	MaterialPorts[PhysicalAllocation="TubeOut"].Flow,Liquid1Phase,ThermodynamicProperties,HeatO
TubeSideLiquidOutletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="TubeOut"].Flow,Liquid1Phase,TransportProperties,ThermalCon
TubeSideLiquidOutletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="TubeOut"].Flow,Liquid1Phase,TransportProperties,Viscosity
TubeSideMinimumDesignMetalTemperature	Real	Temperature	MinimumDesignCriteria(1).MetalTemperature

FIG. 4V

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TubeSideNoncondensableInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"],Flow,NonCondensibles,MassFlowRate
TubeSideNoncondensableInletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeIn"],Flow,NonCondensibles,MolecularWeight
TubeSideNoncondensableOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeOut"],Flow,NonCondensibles,MassFlowRate
TubeSideNoncondensableOutletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeOut"],Flow,NonCondensibles,MolecularWeight
TubeSideOutletNozzleInsideDiameter	Real	Length	Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],Bore
TubeSideOutletNozzleNumber	Integer	Quantity Type	Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],Number
TubeSideOutletNozzleNumber	Integer		Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],Number
TubeSideOutletNozzleRating	eNozzleRating2_PIP VEC		Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],Rating
TubeSideOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],Rho2
TubeSideOutletNozzleSize	Real	Length	Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],NominalSize
TubeSideOutletNozzleType	String		Assemblies,Bundle,Nozzles[NozzleFunction="Outlet"],Type
TubeSideOutletSurfaceTension	Real	Surface Tension	
TubeSideOutletTemperature	Real	Temperature tmp	MaterialPorts[PhysicalAllocation="TubeOut"],Flow,BulkFlow,Temperture
TubeSidePassesMaximum	Real		
TubeSidePassesMinimum	Real		
TubeSidePassesNumberPerShell	Integer		NumberTubePasses
TubeSidePressureDropAllowable	Real	Pressure Diff	Assemblies,Bundle,NormalDesignCriteria,PressureDrop
TubeSidePressureDropCalculated	Real	Pressure Diff	Assemblies,Bundle,NormalOperatingCriteria,PressureDrop
TubeSideSteamInletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeIn"],Flow,Steam,MassFlowRate
TubeSideSteamOutletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeOut"],Flow,Steam,MassFlowRate
TubeSideTestPressure	Real	Pressure abs	Assemblies,Bundle,InspectionAndTests,HydrostaticTestPressure
TubeSideTotalFluidQuantity	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"],Flow,BulkFlow,MassFlowRate
TubeSideVaporInletDensity	Real	Density	MaterialPorts[PhysicalAllocation="TubeIn"],Flow,VapourPhase,PvtProperties,DensityMassBasis
TubeSideVaporInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"],Flow,VapourPhase,MassFlowRate

FIG. 4W

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TubeSideVaporInletFlow	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.MolecularWeight
TubeSideVaporInletSpecificHeat	Real	Spec Heat Cap(Ma	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.ThermodynamicProperties.HeatCa
TubeSideVaporInletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.TransportProperties.ThermalConc
TubeSideVaporInletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.TransportProperties.Viscosity
TubeSideVaporOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.PvtProperties.DensityMassBasis
TubeSideVaporOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.MassFlowRate
TubeSideVaporOutletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.MolecularWeight
TubeSideVaporOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies.Bundle.Nozzles[NozzleFunction="VaporOutlet"].RhoV2
TubeSideVaporOutletNozzleSize	Real	Length small	Assemblies.Bundle.Nozzles[NozzleFunction="VaporOutlet"].NominalSize
TubeSideVaporOutletNozzleType	String		Assemblies.Bundle.Nozzles[NozzleFunction="VaporOutlet"].Type
TubeSideVaporOutletSpecificHeat	Real	Spec Heat Cap(Ma	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.ThermodynamicProperties.HeatC
TubeSideVaporOutletThermalConductivity	Real	Thermal Conductivi	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.TransportProperties.ThermalCon
TubeSideVaporOutletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.TransportProperties.Viscosity
TubeSideVelocity	Real	Velocity	Assemblies.PerformanceCriteria.TubesidePerformance.MidpointVelocity
TubeSideVentNozzleNumber	Integer		Assemblies.Bundle.Nozzles[NozzleFunction="Vent"].Number
TubeSideVentNozzleRating	eNozzleRating2_PIP VEC		Assemblies.Bundle.Nozzles[NozzleFunction="Vent"].Rating
TubeSideVentNozzleSize	Real	Length	Assemblies.Bundle.Nozzles[NozzleFunction="Vent"].NominalSize
TubeSideWaterInletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.CoolingWater.MassFlowRate
TubeSideWaterOutletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.CoolingWater.MassFlowRate
TubesInWindowNumberOf	Real		
TubeSlope	Real	Plane Angle	Assemblies.Bundle.Slope
TubeSupport	String		Assemblies.Bundle.BundleSupport.Type
TubeThermalConductivity	Real	Thermal Conductivi	Assemblies.Bundle.TubeType(1).MaterialOfConstruction.ThermalConductivity
TubeThickness	Real	Length	Assemblies.Bundle.TubeType(1).WallThickness

FIG. 4X

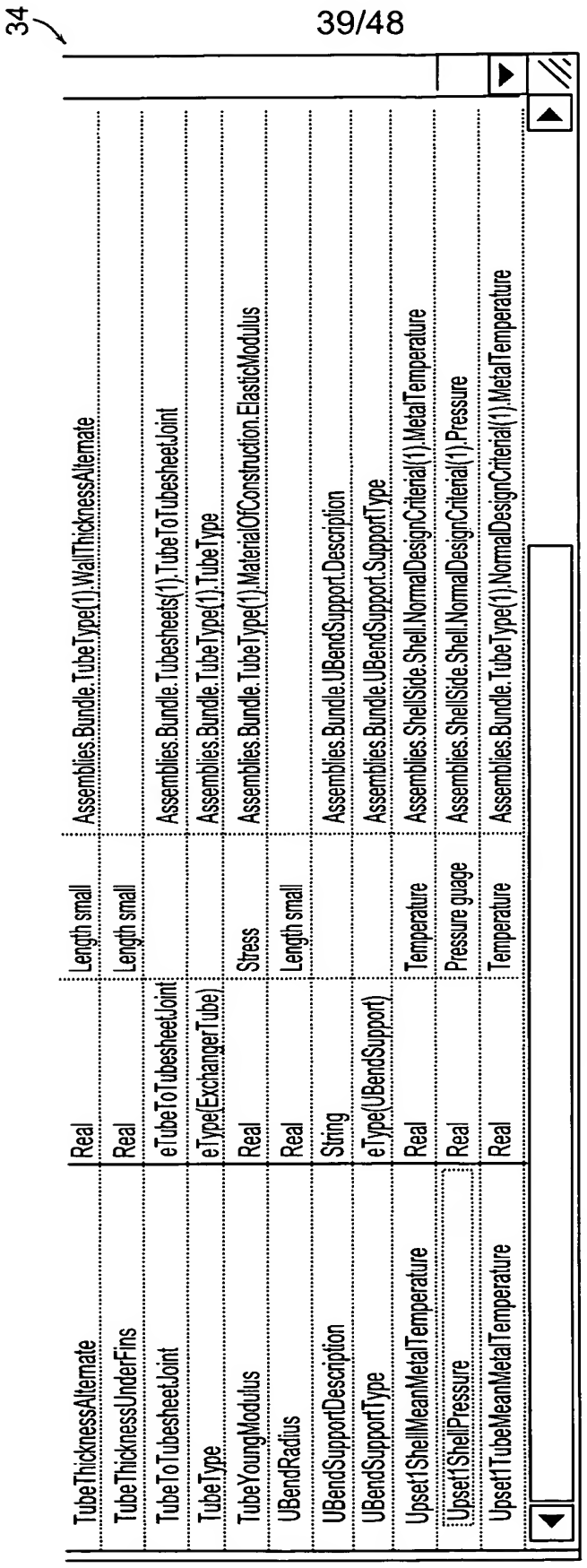
34
TubeThicknessAltemate
Real
Length small
Assemblies.Bundle.TubeType(1).WallThicknessAltemate
TubeThicknessUnderFins
Real
Length small
TubeToTubesheetJoint
eTubeToTubesheetJoint
Assemblies.Bundle.Tubesheets(1).TubeToTubesheetJoint
TubeType
eType(ExchangerTube)
Assemblies.Bundle.TubeType(1).TubeType
TubeYoungModulus
Real
Stress
Assemblies.Bundle.TubeType(1).MaterialOfConstruction.ElasticModulus
UBendRadius
Real
Length small
UBendSupportDescription
String
Assemblies.Bundle.UBendSupport.Description
UBendSupportType
eType(UBendSupport)
Assemblies.Bundle.UBendSupport.SupportType
Upset1ShellMeanMetalTemperature
Real
Temperature
Assemblies.ShellSide.Shell.NormalDesignCriteria(1).MetalTemperature
Upset1ShellPressure
Real
Pressure guage
Assemblies.ShellSide.Shell.NormalDesignCriteria(1).Pressure
Upset1TubeMeanMetalTemperature
Real
Temperature
Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).MetalTemperature

FIG. 4Y

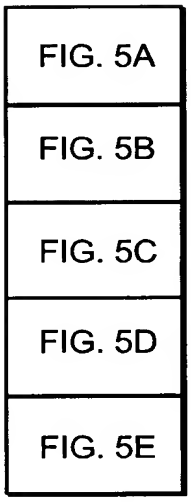

FIG. 5

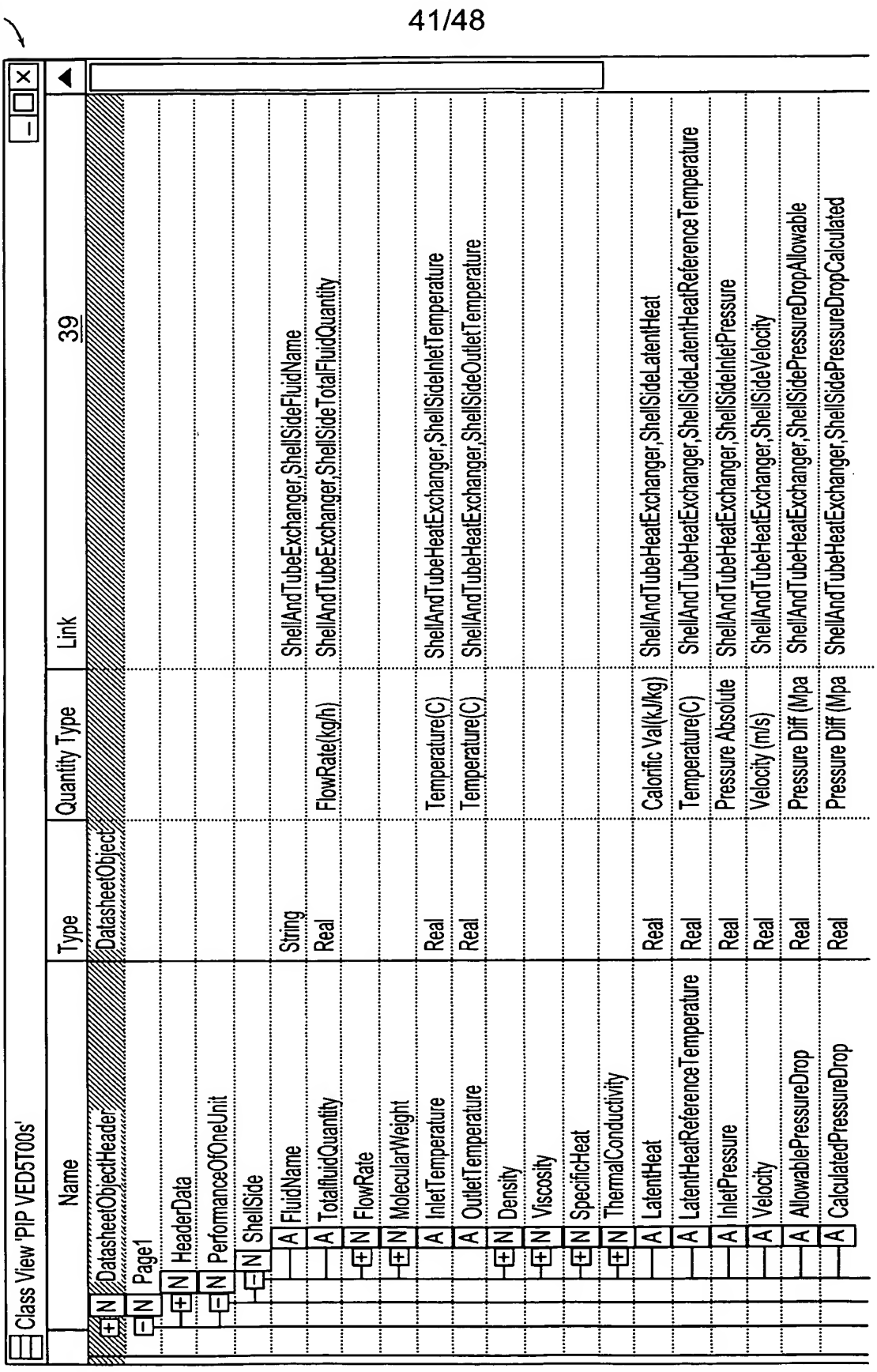
38
Class View 'PIP VED5T00s'
Name
Type
Quantity Type
Link
39
DatasheetObjectHeader
DatasheetObject
Page1
HeaderData
PerformanceOfOneUnit
ShellSide
FluidName
String
ShellAndTubeExchanger,ShellSideFluidName
TotalfluidQuantity
Real
FlowRate(kg/h)
ShellAndTubeExchanger,ShellSideTotalFluidQuantity
FlowRate
MolecularWeight
InletTemperature
Real
Temperature(C)
ShellAndTubeHeatExchanger,ShellSideInletTemperature
OutletTemperature
Real
Temperature(C)
ShellAndTubeHeatExchanger,ShellSideOutletTemperature
Density
Viscosity
SpecificHeat
ThermalConductivity
LatentHeat
Real
Calorific Val(kJ/kg)
ShellAndTubeHeatExchanger,ShellSideLatentHeat
LatentHeatReferenceTemperature
Real
Temperature(C)
ShellAndTubeHeatExchanger,ShellSideLatentHeatReferenceTemperature
InletPressure
Real
Pressure Absolute
ShellAndTubeHeatExchanger,ShellSideInletPressure
Velocity
Real
Velocity (m/s)
ShellAndTubeHeatExchanger,ShellSideVelocity
AllowablePressureDrop
Real
Pressure Diff (Mpa
ShellAndTubeHeatExchanger,ShellSidePressureDropAllowable
CalculatedPressureDrop
Real
Pressure Diff (Mpa
ShellAndTubeHeatExchanger,ShellSidePressureDropCalculated

FIG. 5A

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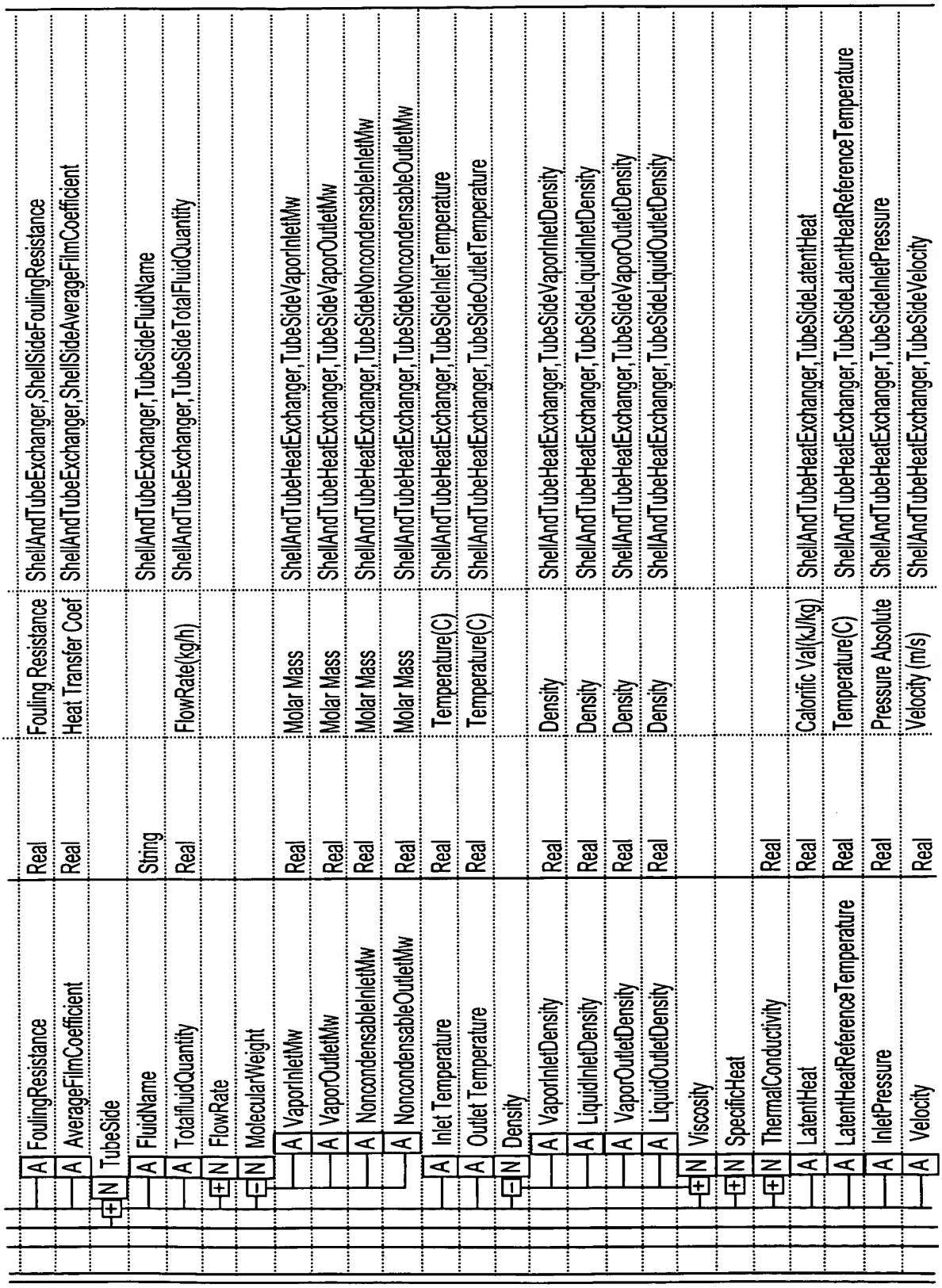
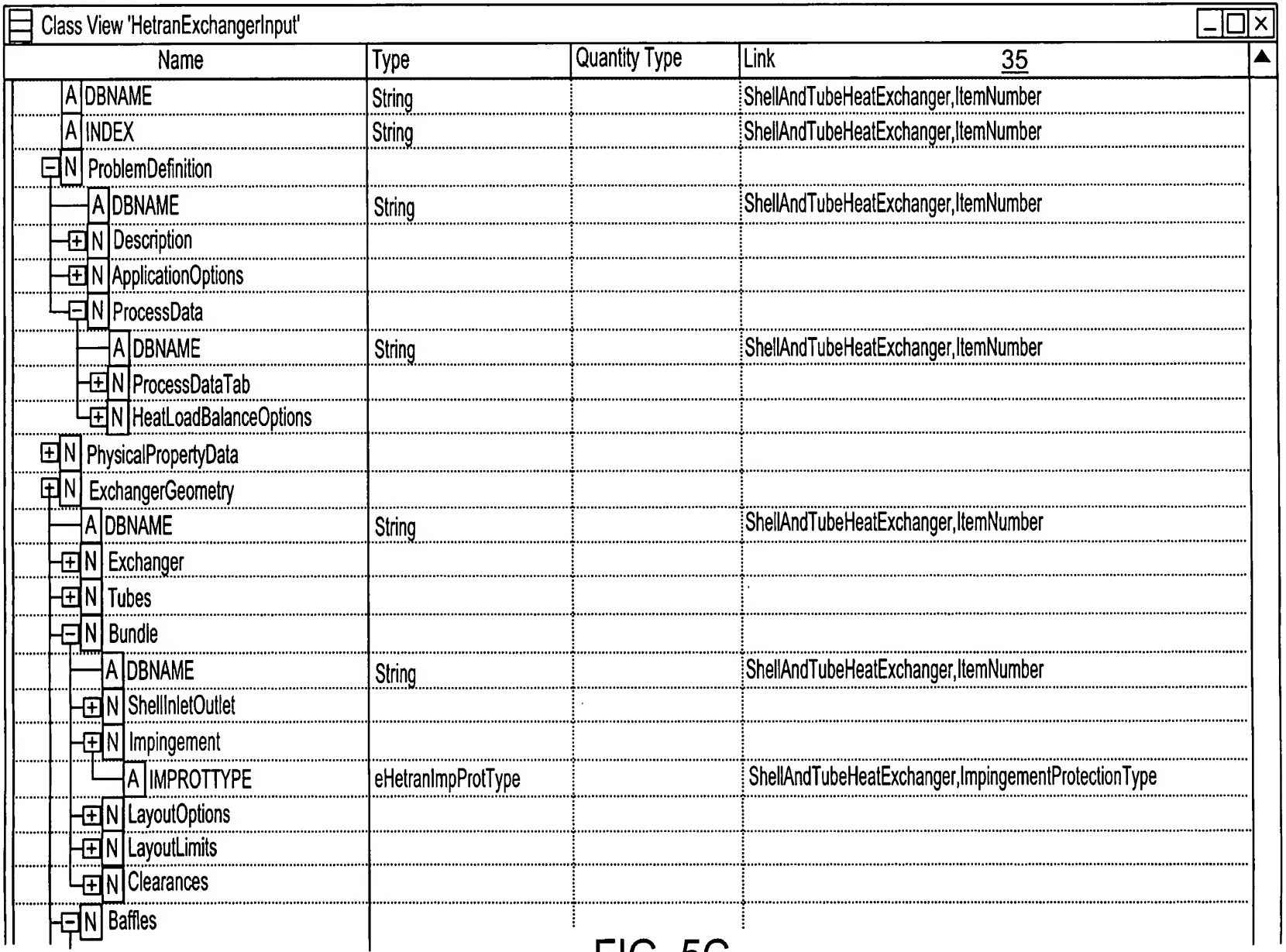

FoulingResistance
AverageFilmCoefficient
TubeSide
FluidName
TotalfluidQuantity
FlowRate
MolecularWeight
VaporInletMw
VaporOutletMw
NoncondensableInletMw
NoncondensableOutletMw
Inlet Temperature
Outlet Temperature
Density
VaporInletDensity
LiquidInletDensity
VaporOutletDensity
LiquidOutletDensity
Viscosity
SpecificHeat
ThermalConductivity
LatentHeat
LatentHeatReferenceTemperature
InletPressure
Velocity
Real
String
Fouling Resistance
Heat Transfer Coef
Calorific Val(kJ/kg)
Temperature(C)
Pressure Absolute
Velocity (m/s)
ShellAndTubeExchanger,ShellSideFoulingResistance
ShellAndTubeExchanger,ShellSideAverageFilmCoefficient
ShellAndTubeExchanger,TubeSideFluidName
ShellAndTubeExchanger,TubeSideTotalFluidQuantity
ShellAndTubeHeatExchanger,TubeSideVaporInletMw
ShellAndTubeHeatExchanger,TubeSideVaporOutletMw
ShellAndTubeHeatExchanger,TubeSideNoncondensableInletMw
ShellAndTubeHeatExchanger,TubeSideNoncondensableOutletMw
ShellAndTubeHeatExchanger,TubeSideInletTemperature
ShellAndTubeHeatExchanger,TubeSideOutletTemperature
ShellAndTubeHeatExchanger,TubeSideVaporInletDensity
ShellAndTubeHeatExchanger,TubeSideLiquidInletDensity
ShellAndTubeHeatExchanger,TubeSideVaporOutletDensity
ShellAndTubeHeatExchanger,TubeSideLiquidOutletDensity
ShellAndTubeHeatExchanger,TubeSideLatentHeat
ShellAndTubeHeatExchanger,TubeSideLatentHeatReferenceTemperature
ShellAndTubeHeatExchanger,TubeSideInletPressure
ShellAndTubeHeatExchanger,TubeSideVelocity

FIG. 5B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Name
Type
Quantity Type
Link 35
A DBNAME String ShellAndTubeHeatExchanger,ItemNumber
A INDEX String ShellAndTubeHeatExchanger,ItemNumber
N ProblemDefinition
A DBNAME String ShellAndTubeHeatExchanger,ItemNumber
N Description
N ApplicationOptions
N ProcessData
A DBNAME String ShellAndTubeHeatExchanger,ItemNumber
N ProcessDataTab
N HeatLoadBalanceOptions
N PhysicalPropertyData
N ExchangerGeometry
A DBNAME String ShellAndTubeHeatExchanger,ItemNumber
N Exchanger
N Tubes
N Bundle
A DBNAME String ShellAndTubeHeatExchanger,ItemNumber
N ShellInletOutlet
N Impingement
A IMPROTTYPE eHetranImpProtType ShellAndTubeHeatExchanger,ImpingementProtectionType
N LayoutOptions
N LayoutLimits
N Clearances
N Baffles
37

FIG. 5C

37

A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
N BafflesTab			
A BAFTYPE	eHetranBafType		
A BAFCUTPERC	Real	Percentage PQT	ShellAndTubeHeatExchanger.BaffleCut
A BAFORIE	String		ShellAndTubeHeatExchanger.BaffleCutOrientation
N TubeSupports			
N RatingSimulationData			
A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
N RatingSimulationGeometry			
A SHLID	Real	Length small	ShellAndTubeHeatExchanger.ShelDiameterInner
A SHLOD	Real	Length small	ShellAndTubeHeatExchanger.ShelDiameterOuter
A BAFSPCCC	Real	Length small	ShellAndTubeHeatExchanger.BaffleSpacing
A BAFSPCIN	Real	Length small	ShellAndTubeHeatExchanger.BaffleSpacingFromInlet
A BAFSPCOUT	Real	Length small	ShellAndTubeHeatExchanger.BaffleSpacingFromOutlet
A BAFNUM	Integer		ShellAndTubeHeatExchanger.BafflesNumber
A TUBELNG	Real	Length small	ShellAndTubeHeatExchanger.TubeLengthStraight
A TUBENUM	Integer		ShellAndTubeHeatExchanger.TubeNumber
A TUBEPASSNUM	Integer		ShellAndTubeHeatExchanger.TubePassesNumberPerShell
A SHLSERNUM	Integer		ShellAndTubeHeatExchanger.ShellsInSeriesNumber
A SHLPARNUM	Integer		ShellAndTubeHeatExchanger.ShellsInParalleiNumber
N KettleVapourBelt			
A KETLOD	Real	Length small	ShellAndTubeHeatExchanger.KettleDiameterOuter
A KETLID	Real	Length small	ShellAndTubeHeatExchanger.KettleDiameterInner
A VAPBLTOD	Real	Length small	ShellAndTubeHeatExchanger.VaporBeltDiameterOuter
A VAPBLTID	Real	Length small	ShellAndTubeHeatExchanger.VaporBeltDiameterInner

FIG. 5D

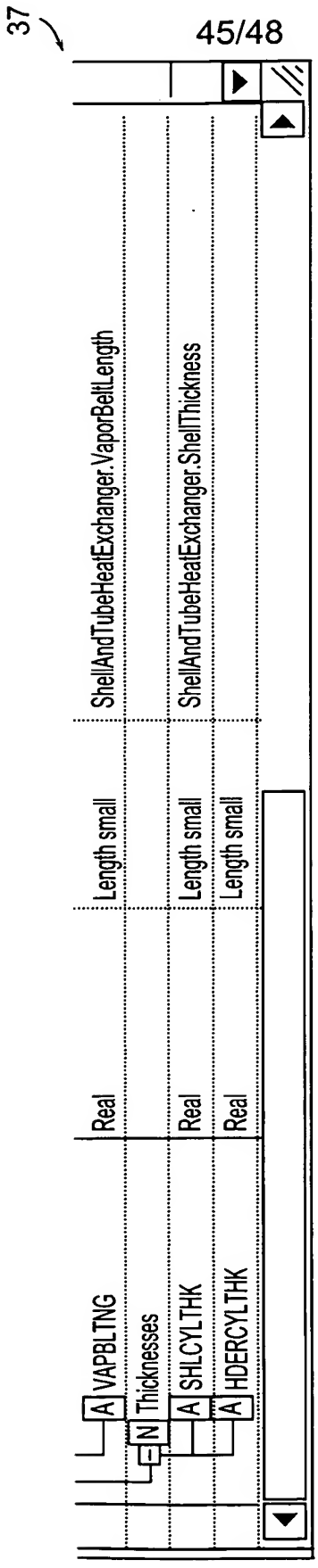
37
45/48
ShellAndTubeHeatExchanger.VaporBeltLength
ShellAndTubeHeatExchanger.ShellThickness
Length small
Length small
Length small
Real
Real
Real
A VAPBLTNG
N Thicknesses
A SHLCYLTHK
A HDERCYLTHK

FIG. 5E

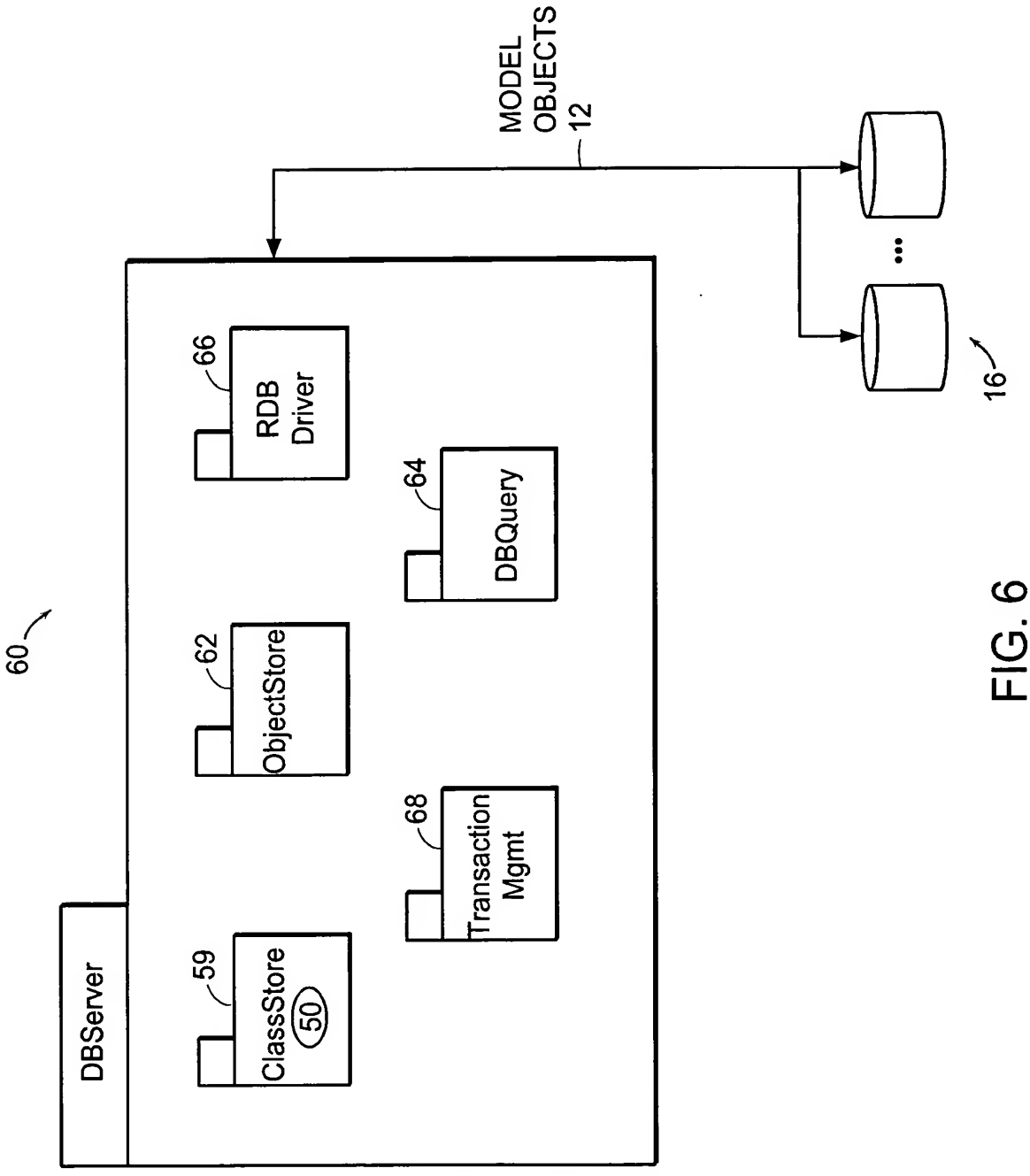
MODEL OBJECTS
12
16
60
66
RDB Driver
64
DBQuery
62
ObjectStore
68
Transaction Mgmt
59
ClassStore
50
DBServer

FIG. 6

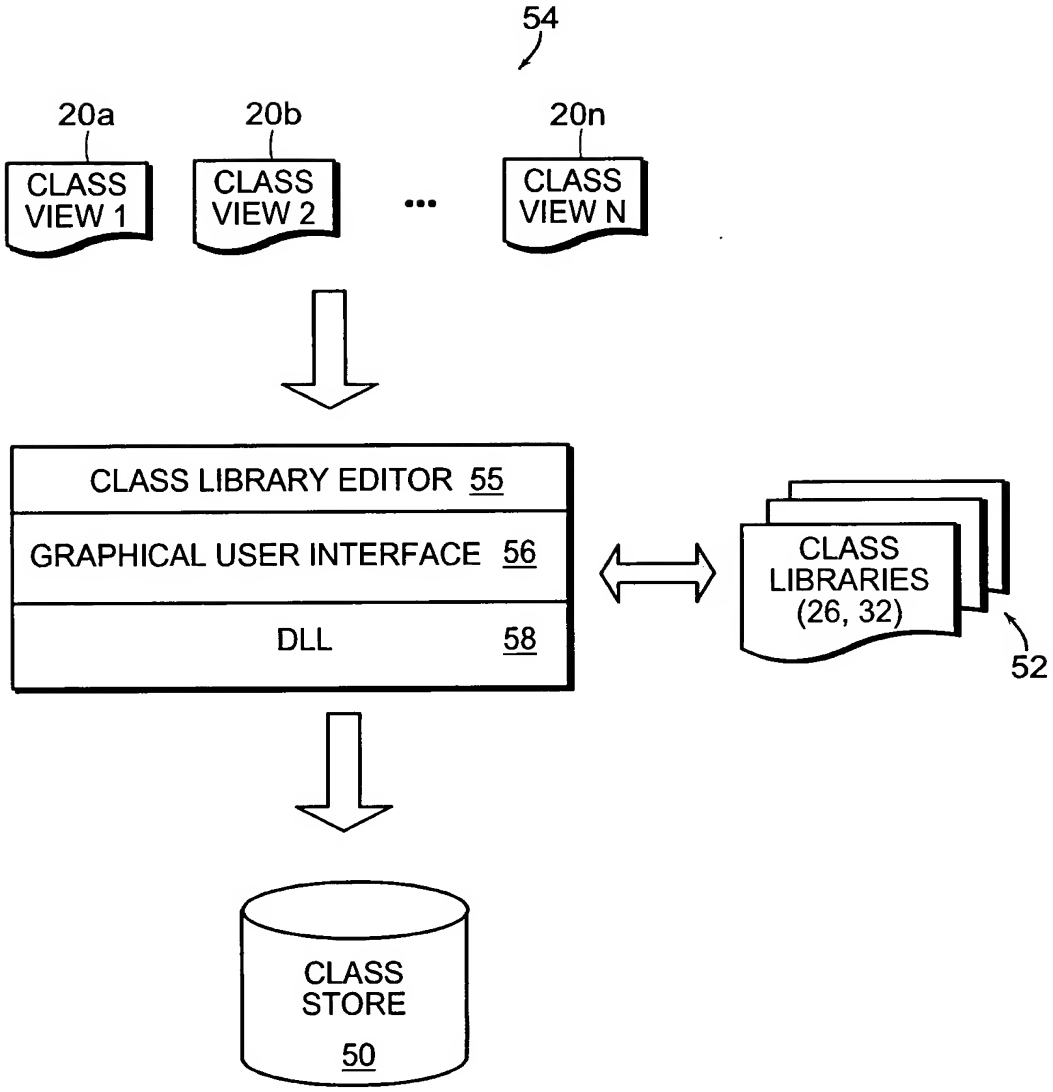
54
20a
20b
20n
CLASS VIEW 1
CLASS VIEW 2
...
CLASS VIEW N
CLASS LIBRARY EDITOR 55
GRAPHICAL USER INTERFACE 56
DLL 58
CLASS LIBRARIES (26, 32)
52
CLASS STORE 50

FIG. 7

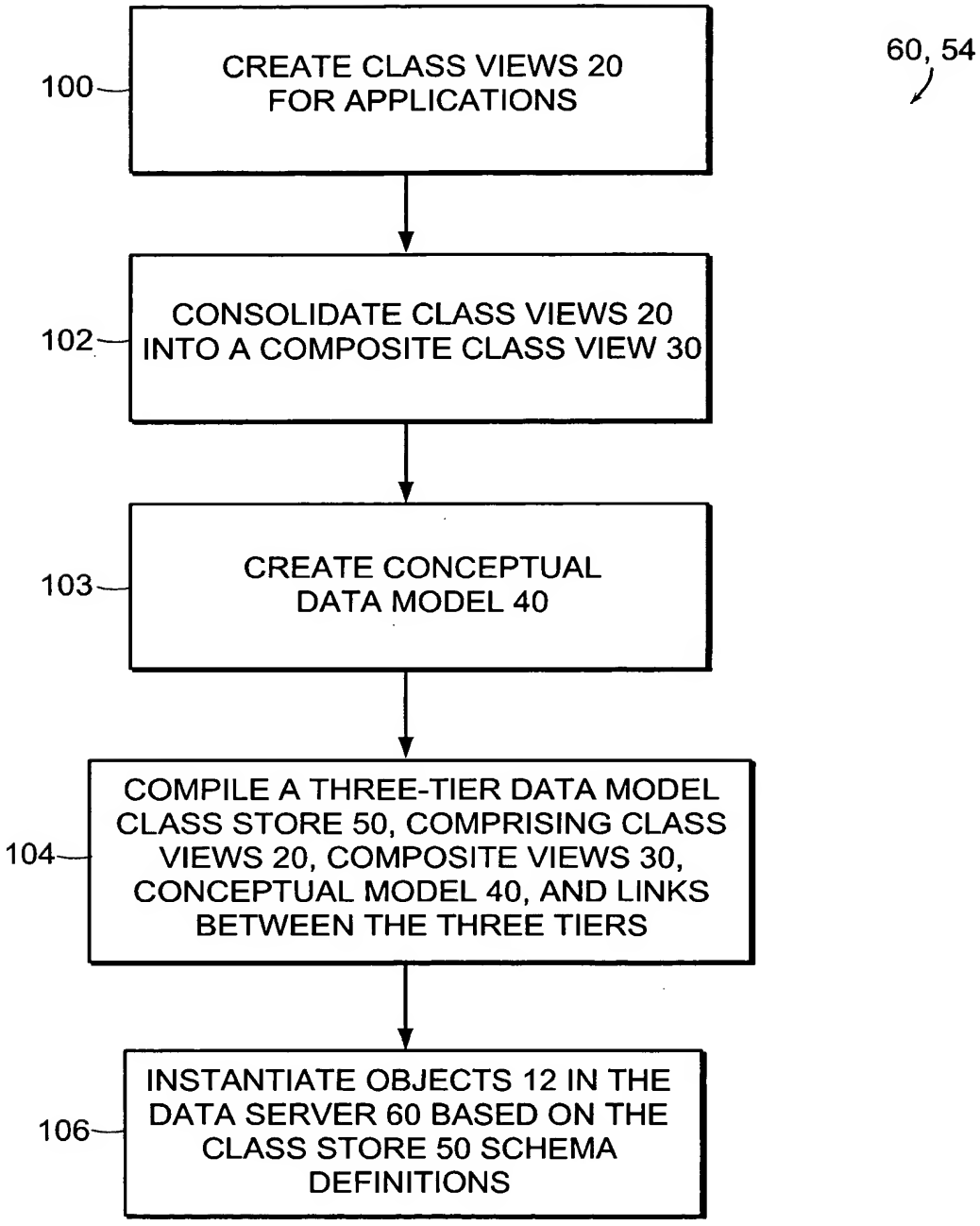
60, 54
100
CREATE CLASS VIEWS 20 FOR APPLICATIONS
102
CONSOLIDATE CLASS VIEWS 20 INTO A COMPOSITE CLASS VIEW 30
103
CREATE CONCEPTUAL DATA MODEL 40
104
COMPILE A THREE-TIER DATA MODEL CLASS STORE 50, COMPRISING CLASS VIEWS 20, COMPOSITE VIEWS 30, CONCEPTUAL MODEL 40, AND LINKS BETWEEN THE THREE TIERS
106
INSTANTIATE OBJECTS 12 IN THE DATA SERVER 60 BASED ON THE CLASS STORE 50 SCHEMA DEFINITIONS

FIG. 8